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Vol. VI] February 1938 [No. 8

	Page
The Indian Science Congress	367
On the Age of the Deccan Trap as Evidenced by Fossil Fish-Remains. By Sunder Lal Hora, D.Sc., F.R.S.E., F.N.I.	370
The Fisheries of Bengal—Can They be Improved and Developed? By J. Travis Jenkins.	373
Calcareous Algæ from the Inter-Trappean Beds Near Rajahmundry. By S. R. Narayana Rao, K. Sripada Rao and Julius Pia	376
Element 87	377
Letters to the Editor	378
Reviews	393
Archæological Notes	401
Astronomical Notes	403
Centenaries. By S. R. Ranganathan, M.A., L.T., F.L.A.	
Bachet, Gaspard (1593–1638)	404
Eberle, John (1787–1838)	404
Beilstein, Fridrich Konrad (1838–1906)	404
Research Items	405
The Central Board of Irrigation in India	407
The Conference of Medical Research Workers in India	408
His Highness the Maharaja's Observatory, Trivandrum	410
Science Notes	412
Academies and Societies	418
Supplement: Indian Science Congress—Silver Jubilee Session, Calcutta, 1938	419

The Indian Science Congress.

THE growth of the Indian Science Congress, in our opinion, owes a great deal to the policy of university expansion adopted by the Government of India in pursuance of the recommendations of the Curzon and Sadler Commissions on University Education appointed by the Government of India. With the reorganisation of the older universities in order to improve the standard of education and to promote research, and with the inauguration of new teaching universities in various parts of the country in the second and third decades of the present century, the objects of the Indian Science Congress Association were fulfilled to a very considerable extent. The Indian States which, with the exception of Mysore, seemed to lag behind the provinces of British India in attracting the Indian Science Congress to their centres of education, are now making up for lost time. Two consecutive sessions, in 1936 and 1937 in the Indore and Hyderabad States respectively, afford sufficient proof of the earnestness of the Indian States to be benefited by the deliberations of the Indian Science Congress. Travancore State is well on the way to claim the attention of the Science Congress.

In his Presidential Address to the 15th Indian Science Congress, Professor Simonson rightly laid stress on the value of opportunities which the Congress has given to professors and students and to research workers to establish personal contacts, which otherwise would have been extremely difficult, if not impossible, in this land of distances. With the increased specialization in various branches of science, which has become an unavoidable necessity in the modern scientific world, the need for these contacts in specialist's societies organised for the purpose has become urgent, and we have consequently in India at present nearly a dozen societies each dealing with a special branch of science, such as Statistics, Biological Chemistry, Soil Chemistry, Physiology, Psychology, Entomology, etc. The members

of these societies meet at least once a year under the auspices of the Indian Science Congress Association. The opportunities provided by these societies for purposes of discussion and publication of scientific results have, however, proved to be inadequate, and a few Science Academies such as those at Allahabad and Bangalore have come into being to provide these facilities to their fellows. The inauguration of the National Institute of Sciences in 1935 as a co-ordinating organisation has also been necessitated by the enormous output of scientific work in India.

In a world that has for long been dominated by the idea of the intellectual superiority of man over the opposite sex, it is easy to fail to appreciate the part that Indian women have played in the advancement of scientific knowledge. The proceedings of the Indian Science Congress, however, bear ample evidence to the fact that Indian women are not far behind their Western sisters in regard to active participation in scientific research. It will perhaps come as an agreeable surprise to many when told that Indian women scientists have contributed original papers to the Jubilee Session on a variety of subjects ranging from astrophysics, physical, organic and industrial chemistry and geography to the biological sciences such as morphology, ecology, physiology, anthropology, genetics and psychology. It has been said that science knows no politics, but no one believes that scientists do not know it too well. The Indian Science Congress has not been free from internal politics. The constitution of the Science Congress was for some years not above cirticism, but its rules and regulations have been changed from time to time to suit the needs of the hour. From a semi-permanent body which came into existence in a new garb every year, it very recently became a permanent association with a certain continuity of policy, but its financial resources have always been very limited. The annual subscriptions from ordinary and sessional members are hardly enough to meet the running expenses of the Association. As the activities of the Association are confined to the convening of the annual meeting and the publication of the Congress Proceedings, there has been no need to accumulate funds. The expenses of the actual meeting at various places are met by local reception committees which raise funds by public donations. The annual contributions from the Royal Asiatic Society of Bengal, the Government of India, the Indian Universities, and other public bodies have saved the Indian Science Congress Association from serious financial embarrassments. The connection of the Indian Science Congress Association with the Royal Asiatic Society of Bengal continues to be informal but beneficial, and it is to be hoped that the present relationship would be maintained.

The inauguration ceremony of the Jubilee Session was as picturesque as the sectional meetings of the Science Congress were important. The evening addresses given by some of the distinguished visitors were attended by enormous crowds which inundated the Senate Hall and the overflow had to settle in the adjacent quadrangle. The organisers had wisely installed loud-speakers for the benefit of those not fortunate enough to gain admission to the Hall. The excursion programmes for the afternoons, and the social gatherings arranged by the local secretaries were equally well attended. The intervals between the afternoon programmes being very short, there was, amongst many delegates, a feeling of rush and hustle which made contacts between delegates of the various sections difficult. In most of the sectional meetings the hustle was equally evident. The number of papers accepted for reading was so large that the presidents of sections were unable to afford adequate facilities for discussion. The joint discussions under the auspices of two or more sections proved no more than the reading of dissertations by the participants. The purpose and significance of discussion seemed to have been lost sight of by many, and in consequence much valuable time was lost in the reading of individual papers. We have no doubt that the success of the Jubilee Session of the Indian Science Congress was unique, though a certain amount of rush was inevitable. We will return to a consideration of these points a little later.

The British and Continental European delegates freely mixed with Indian Scientists and established friendly relations with such of the latter as had common interests not only in Calcutta but in all other places visited by them. The public were deeply interested in their evening addresses, which

were at once illuminating and important. We feel sure that they carry pleasant recollections of their sojourn in India, and a correct appreciation of the scientific progress in this country and of the aspirations of Indian Scientists.

The Indian Science Congress has, within the last quarter of a century, made the country science-minded, and what we need for the present and for the future is not only more science but a close co-operation between scientists themselves, between scientists and politicians, and between scientists and capitalists who are interested in industry and the economic development of the country.

A snug satisfaction with our acheivements, however great, is apt to deflect us from the path of progress, and a periodical stock-taking of our shortcomings would therefore be of considerable value. The growth of the Indian Science Congress in twenty-five years cannot be measured in terms of the mere increase in the numerical strength of its membership, nor even in terms of the number of scientific papers contributed. A critical examination of the papers communicated to the Congress would show that a large majority do not lend themselves to a profitable discussion. Many of them err on the side of verbosity rather than on that of brevity. Some papers have necessarily to be taken as read either because the authors are not present, or because there is no time during the session to read them. Some of the papers read have either been presented or published elsewhere, or have been parts of preliminary accounts previously published. A few are monotonously descriptive interesting no one in the meeting, often not even the author, while still a fewer are repetitions of problems solved in other parts of the world. Some papers reveal that their authors are not fully acquainted with the work done previously on that subject. The subject-matter of one paper is often split up into several short papers each dealing with some closely allied aspect of the same subject. These and other little shortcomings could be avoided if sectional presidents and their referees use their prerogative of careful selection from amongst the papers submitted of such of them as could be discussed with advantage, both to the authors of papers and to their scientific colleagues. We do not suggest that those responsible for admitting papers are actuated by motives of fear or favour in the discharge of their duties, but we believe that the almost religious tendency amongst many of us in this country to avoid conflict at any cost is responsible for misplaced sympathy, where well-meant criticism would have been constructive and beneficial. Reform in this respect is greatly to be desired, but without the co-operation of all concerned it would be impossible to separate the grain from the chaff. The proper function of the Indian Science Congress is, in our opinion, not the reading of original scientific contributions, but that of stimulating discussion on topics of general scientific interest and of focussing the attention of the Indian people on the scientific approach to the problems of life. Scientific Societies and Academies, the formation of which in all provincial capitals and university centres should be encouraged, would come into their own and facilitate the reading and publication of original scientific contributions. The Indian Science Congress as an annual peripatetic body can only bring together scientists from all parts of the country for the purpose of mutual contacts and exchange of ideas, and cannot take the place of scientific societies and academies. We are glad to note in this connection that a resolution which has the same object as we have in view submitted by a member of the Executive Committee will come up for consideration by the General Committee at the next session of the Indian Science Congress.

The key-note of the success of the Silver Jubilee Session may be summed up in the word, " co-operation ". The Governments, universities and other public bodies of India, the members of the local Reception Committee at Calcutta and of the Indian Science Congress, and the Indian Press on the one hand, and the members of the British and foreign delegations on the other, have worked together for one common purpose, namely, the promotion of science and of the well-being of humanity as a whole.

On the Age of the Deccan Trap as Evidenced by Fossil Fish-Remains.[1]

By Sunder Lal Hora, D.Sc., F.R.S.E., F.N.I.,
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AT the discussion on the age of the Deccan Trap, held at the Hyderabad (Deccan) meeting of the Indian Science Congress, several speakers referred to the great stratigrahpical value of the Inter-trappean fossils, and casual references were made by Crookshank, Sahni and the writer to the fossil fish-remains discovered from the inter-trappean beds. Since then the extensive material collected by Mr. H. Crookshank from the inter-trappeans of Deothan and Kheri has been worked out, though the results[2] have not yet been published. A few fossil scales from the inter-trappeans (Lameta ?) at Dongargaon,[3] Takli and Paharsingha, collected by Rev. Hislop and now preserved in the collection of the Geological Survey of India, have also been examined; these very fragmentary remains had not hitherto been studied by any specialist. Some fossil scales from the infra-trappean bed at Dhamni, east of Warora, collected by Mr. F. Fedden have also been examined. The present investigation, when combined with that of A. S. Woodward's (1908) on the fossil fish-remains from the Lameta beds at Dongargaon, throws considerable light on the probable age of these beds.

From a stratigraphical point of view the results obtained so far may be tabulated as follows :—

Name of bed	*Type of fish*	*Geological Horizon*
Lameta, Dongargaon	*Lepidosteus indicus* A. S. Woodw.	Typically tertiary; Lower Eocene to present day in America.
,, ,,	*Pycnodus lametæ* A. S. Woodw.	Not later than close of Eocene.
,, ,,	*Eoserranus hislopi* A. S. Woodw.	Tertiary.
(?) Inter-trappean (possibly Lameta), Dongargaon.	*Clupea* sp. ; scale.	" Not known from below the Upper Eocene " (Zittel).
Infra-trappean, Dhamni.	*Clupea* sp. ; scales.	Do.
Inter-trappean, Paharsingha.	*Lepidosteus* spp. ; scales	Tertiary.
Inter-trappean, Takli.	*Nandid* scale.	Fossils of the family not known.
Inter-trappean, Deothan and Kheri.	*Clupea* spp. ; scales.	As known at present from Upper Eocene to recent.
Do.	*Mugeria* sp. ; scales.	Old Tertiary.
Do.	Cyprinid scale.	Lower Eocene to recent.
Do.	Polyacanthid scale.	Fossils of the family not known.
Do.	*Serranus* sp.	Tertiary to recent.
Do.	*Nandus* sp.	Fossils of the family not known.
Do.	*Pristolepis* sp.	Do.

In all 10 principal types of fish have been discovered so far from the trappean beds. Of these, *Lepidosteus* and *Pycnodus* are Ganoid fishes which " exhibit their greatest development in Palæozoic, Triassic and Jurassic formations; and from the base of the Cretaceous system upwards they become more and more replaced by the bony fishes. The few still existing Ganoids live either exclusively, or at least partly, in fresh-water, while the large majority of the fossil forms occur in purely marine deposits. As a rule, only the Devonian and Tertiary Ganoids occur in fresh-water formations." From India, however, the remains of fresh-water Ganoids are known from the Kota Maleri beds of the Mesozoic period, from the Lameta beds at Dongargaon and from the Inter-trappeans[4] at Paharsingha. About

[1] Read in the Geology Section at the Jubilee Session of the Indian Science Congress held at Calcutta, and published with permission of the Director, Zoological Survey of India.

[2] The detailed results of these investigations will be published in the *Records of the Geological Survey of India.*

[3] A scale of *Clupea* sp. in the collection of the Geological Survey of India is registered as having been obtained by Rev. Hislop from the inter-trappean bed at Dongargaon. Mr. H. Crookshank, however, informs me that, as far as is known, there are no inter-trappean beds at Dongargaon but only Lameta beds.

[4] Since the above was written, Mr. S. R. Narayan Rao has discovered the remains of *Lepidosteus* scales in the inter-trappean bed at Kateru near Rajahmundry. Through the kindness of Prof. B. Sahni, I was given an opportunity to examine the Kateru specimen.

Lepidosteus Woodward (1908) observed that it is "typically Tertiary, differing essentially from the numerous secondary Ganoids to which it is related, by its highly specialised vertebræ. It ranges from the Lower Eocene to the Lower Miocene in Europe, and from Eocene to the present day in North America." With regard to *Pycnodus*, he stated that "according to European standard, cannot be later than the close of the Eocene." *Eoserranus* is a Percoid fish of a very primitive type, as its scales have not assumed the typical features of the modern Acanthopterygian fishes. Woodward says that "No true Percoid has hitherto been recognised in a typically Cretaceous formation in any part of the world." Accordingly, he fixed the age of the Lameta fish-fauna of Dongargaon to be between the Danian Cretaceous and the Upper Eocene.

From the inter-trappean (Lameta ?) bed at Dongargaon, Hislop collected a nicely preserved scale of *Clupea* Linn. in which the transverse radii are complete and well marked. According to Zittel, *Clupea* is "not certainly known below the Upper Eocene of Monte Bolca, near Verona." This record would seem to fix the age of the Dongargaon beds as Upper Eocene, but it may be that the remains of *Clupea* have not yet been recognised from the older formations, for the family Clupeidæ dates from the Cretaceous period.

The scales from the infra-trappean bed at Dhamni also belong to the genus *Clupea* and are very similar to the scale found at Dongargaon.

The inter-trappeans at Paharsingha contain small *Lepidosteus* scales, while those at Takli contain a very primitive type of *Nandid* scale. The Nandidæ belong to the Percoid group and presumably are not older than the Tertiary period. Though no fossil remains of the Nandidæ are known, these fishes must have been in existence at a time when there was still a land connection between India, Africa and South America, for their close allies of the family Polycentridæ are found at the present day in West Africa and South America.

The inter-trappean beds at Deothan and Kheri yielded the remains of Teleostean fishes only. Scales of *Clupea* of two types—some with the transverse radii complete and others with the transverse radii widely interrupted—are very abundant; those with complete transverse radii are similar to the one found in the inter-trappean (Lameta ?) at Dongargaon and the infra-trappean at Dhamni.

The most remarkable discovery is, however, the occurrence of the Osteoglossidæ in the Deothan beds. There are 3 fragments of the characteristic scales of this family which I have referred to the fossil genus *Musperia* Sanders (1934) recently described from the old Tertiary formations of Middle Sumatra. Of all the living Teleostean fishes, Osteoglossidæ have a remarkable distribution; they are found in Australia, Indo-Australian Archipelago, Siam, Africa and South America. It has now been recorded, though in a fossil state, for the first time from India. The Osteoglossidæ grow to a large size; *Arapaima* of South America attains a size of 15 feet and is the largest fresh-water fish known. The fossils of the Osteoglossidæ are found in Tertiary formations only.

There is one fragment of a primitive Cyprinid scale of the sub-family Abramadinæ. The Cyprinoids form the most dominant group among the present-day fresh-water fishes, but they do not extend to below the Lower Eocene.

The rest are all Acanthopterygian fishes which are found in great abundance in seas, estuaries and fresh waters not very far from the coasts. Of these, there is one Labyrinthid scale, probably of the family Polyacanthidæ. The Labyrinthid fishes are found in South-eastern Asia and Africa. There are also numerous scales of *Serranus*, *Nandus* and *Pristolepis*, all Percoid fishes of a highly specialised type. The Serranidæ are mostly marine, but a few occur in fresh waters. The Nandidæ, to which the Pristolepidæ are closely allied, are strictly fresh-water forms; they are represented in Africa and South America by allied forms of the family Polycentridæ. Neither of these families is hitherto represented by any fossil form.

Judging from the present-day geographical distribution of the Pristolepidæ and the Polyacanthidæ and from the present-day migratory habits of certain large species of *Clupea*, the Trappean fish-beds were probably laid down after the supposed severance of the land connection between India and Africa in the early tertiaries. The ecological associations of the Lameta and the inter-trappean fish-faunas also point to the same conclusion. When large fishes of the type of *Eoserranus*, *Lepidosteus* and *Pycnodus* flourished in the Peninsula (the age of the infra-trappean bed at Dongargaon) the main river of the area

was probably very large, placid and deep, and its mouth was not very far from Dongargaon. But by the time the inter-trappeans of Deothan and Kheri were laid down, marshy conditions, with lakes and marshes of varying sizes in the neighbourhood of the mouth of a large river, had been established. The conditions then were probably similar to those now prevailing in the lower reaches of the Ganges. The presence of a considerable number of Clupeoid scales of fairly large size clearly indicates the deltaic nature of such a river not very far from the beds mentioned above. Clupeoids are marine fishes but some, like the Shad of America and the Hilsa of India, ascend into large rivers for long distances and give rise to immense, seasonal fisheries. The occurrence of the Nandidæ, the Pristolepidæ, the Polyacanthidæ and the Serranidæ also indicates the maritime nature of the area, for fishes of these families, even at the present day, are commonly met with in fresh waters usually not very far removed from the sea.

Considerable support is lent to the estuarine nature of the fish-fauna of the inter-trappean beds from the discovery of the remains of a genus of palms, *Nepadites* or *Nipa*, in the inter-trappean beds at Chhindwara, a place not very far away from Deothan and Kheri. As is well known, these palms still survive in the Sundarbans and other tropical estuaries. On this point Sahni (1934) observed that:

> "*Nepadites* is not only a genus very characteristic of the Eocene period but, unless these palms have changed their mode of life since then, its occurrence in the northern part of the Deccan indicates the existence of an *estuary*, during the early part of the Inter-trappean period in the proximity of Chhindwara."

Though the geological data about the drainage of the area are obliterated by the overlying traps, still from the very meagre evidence available Mr. H. Crookshank has been able to support my conclusions concerning the habitat of the Deothan fossil fishes. It also appears probable that all inter-trappean beds are probably not of the same age. Judging from the meagre evidence provided by the fish scales, the inter-trappeans of Paharsingha and Takli would seem to be older than those of Deothan and Kheri. Of course, the Lameta beds at Dongargaon are the oldest of all trappean beds from which fish-remains have been studied so far.

From the above it may be concluded that the infra-trappean beds at Dongargaon and the inter-trappean beds at Paharsingha, Takli, Deothan and Kheri were laid down in the early tertiaries, and that there was probably some interval between the deposition of the infra- and the inter-trappean beds during which the change from a predominantly Ganoid to an almost exclusively Teleostean fauna took place. One thing seems to be fairly certain that ecological conditions usually associated with a large and deep river characterised the infra-trappean period, and that by the advent of the inter-trappean period marshy conditions, usually associated with the mouths of large rivers, had set in.

Summary.

The systematic position of the fossil fish-remains from the infra-trappean beds at Dongargaon and from the inter-trappean beds at Takli, Paharsingha, Deothan and Kheri along with their known geological ages are tabulated. The distribution in space and time of the 10 principal types of trappean fishes is discussed, and it is concluded that these beds were probably laid down in the early tertiaries when the lower part of the supposed land connection between India and Africa had already disappeared and when the area occupied by the beds was not very far from the sea coast. It is further pointed out that there was probably sufficient interval between the formation of the infra- and the inter-trappean beds to permit the change from a predominantly Ganoid fauna, comprising *Lepidosteus* and *Pycnodus* of the Lameta beds at Dongargaon, to a fauna of almost exclusively Teleostean fishes, such as the Clupeidæ, the Osteoglossidæ, the Cyprinidæ and a great variety of Acanthopterygians, in the inter-trappeans at Deothan and Kheri.

From an ecological point of view, one thing seems fairly certain that the conditions usually associated with a large and deep river characterised and infra-trappean period, and that by the advent of the inter-trappean period marshy conditions, usually associated with the mouths of large rivers, had set in.

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The Fisheries of Bengal—Can They be Improved and Developed?

By J. Travis Jenkins,

Superintendent, Lancashire and Western Sea Fisheries Joint Committee, Preston, England.
(Formerly Fishery Adviser, Government of Bengal.)

[Dr. J. Travis Jenkins, whose article on the Fisheries of Bengal we publish below with the greatest pleasure, came out to India in September 1908 as Fishery Adviser to the Government of Bengal and was at once entrusted with the Survey work of the Bay. His Quarterly Reports on the working of the Steam Trawler "*Golden Crown*" and his final report on the "Marine Fishery Investigations of the Bengal Government Steam Trawler '*Golden Crown*', 1908–09" show what an intimate knowledge he had gained of fishery conditions in the Bay within a short period of his stay in India. The present article also indicates the clearness of his ideas about this economic problem and his great mastery of details. Since the departure of Dr. Jenkins, though there was a Fishery Department in Bengal for about a decade, no practical results have been achieved, mainly due to the apathy of the provincial Government. In view of a great popular demand the Government of Bengal has recently borrowed an Officer of the Madras Fisheries Department to advise it regarding the development of estuarine fisheries. In view of this, Dr. Jenkins' proposals are at the moment most welcome. Further, it is a matter of gratification that Dr. Jenkins is still actively engaged in the fishery work in Great Britain and has thus a great deal of up-to-date and first-hand knowledge of current fishery problems. We hope to publish later one or two more articles on different aspects of Indian Fisheries from the pen of this great savant.—*Editor.*]

THE recent appearance of Japanese steam trawlers in the Indian Ocean between Penang and Calcutta and the arrival of a Japanese trawler in the Kidderpore Docks in March last with 200 tons of fish including pomfret, bekti and lobsters caught in the Bay of Bengal has raised again the problem of the fish supply of Calcutta and neighbourhood. According to the Calcutta *Statesman* the markets in Calcutta require about 700–800 maunds of fish daily, but the supply is regarded as insufficient. In the last decade the demand has increased 40 per cent. but the supply 25 per cent.

It is thought, and in some quarters even feared, that this Japanese enterprise will materially affect the future of the fish supply of Calcutta and the Province of Bengal.

Although it is some years now since I left India, perhaps my opinion as to the best way of developing the local fish supply of the Province may be still worth consideration and I have much pleasure in giving it.

It is understood that in what follows attention is given solely to the best means of developing the supply to the markets; and questions of scientific investigation into the future of the fisheries is for the moment left out of consideration.

To put very briefly, there are two main methods by means of which the fish supply of Calcutta may be improved. These are:

1. The expansion and organisation of the local methods of fishing.

2. The introduction of foreign (British) methods of fishing. Of course, a combination of the two methods is not excluded. In my opinion the first of the above two methods is much to be preferred, for reasons set out more fully below.

Any company established in Calcutta for the supply of fresh fish for the Calcutta and neighbouring markets has exceedingly bright prospects, always provided there is good organisation and good management. In addition to the demand in Calcutta itself which according to the *Statesman* amounts to 700–800 maunds daily, there is a market at other places within from 12 to 15 hours rail journey; and even further in the cold weather. It might be possible to develop a trade in oil, isinglass or cured fish but in the first instance every effort should be directed to working up a first-class fresh fish trade.

Of the utmost importance is a first-class manager, an energetic man who should be paid partly by salary and partly by a handsome commission on the net profits. In fact, this method of payment should be adopted wherever practicable since the fish trade, owing to the perishable nature of the products handled, is pre-eminently a business where all employees should have a direct and sharing interest in the profits.

In my opinion there is a big demand in Calcutta for the supply of fresh fish, by way of fixed contracts to such institutions as Clubs, *e.g.*, the United Service, Bengal, etc., Hotels, such as the Great Eastern, Grand, Bristol, etc., Boarding Houses and Chummeries; Railway Company Caterers at Howrah, Asansol, Kurseong, etc.

The shore management of the "*Golden Crown*" made many mistakes, from which it is now permissible to profit. There was

an arbitrary fixed price all the year round. It is difficult to decide on contract prices for high class fish; but people such as those above mentioned who would expect the "pick of the basket" such as pomfret, bummaloes (Bombay Duck), bekti and similar fish, ought to pay not less than one rupee per pound. In times of scarcity even higher prices could be obtained from casual customers.

I believe that a regular up-country trade could be developed to civilians, people engaged in the coal-fields, wealthy country residents, etc. As to the susceptibilities of Indian gentlemen and their family requirements I cannot presume to advise except to refer to the reports published for Bengal by Mr. Gupta and for Eastern Bengal and Assam by Mr. De.

Nothing whatever was done by the Bengal Fishery Department to interest or develop this up-country trade, in my opinion a most lucrative branch of the fish trade; since up-country people would pay anything in reason for good fresh fish, say once a week. In particular Roman Catholics eat fish on Friday and in addition most Europeans like a fish diet one day per week and they select Friday simply because good supplies are generally available on that day. Weekly or bi-weekly parcels should be despatched by the night mails to any place that could be reached by 10 A.M. the following day, or even later in the cold season.

There must be many up-country clubs and chummeries which would be glad of weekly supplies, provided the fish was good and fresh, and for which a good price would be forthcoming.

The shore management of the "*Golden Crown*" turned down offers from country merchants, because it was thought that these country merchants would make a profit on the retail sale of such fish. Surely even an up-country fish merchant cannot live without a margin of profit on his sales. I remember an offer from a dealer at Munshi Bazaar, Asansol, who asked for 5 maunds of fresh fish daily. He offered to deposit Rs. 200 and to pay any reasonable sum for good healthy fish. He asked for *Magur*, *Singi* and *Koi* which are not exactly the best fish available to any well-managed fish company in Calcutta. The fish was to be sent by the 59 up-parcel Express from Calcutta; but was turned down for the reason quoted above.

There is no doubt whatever that a profitable up-country fresh fish trade could be developed from Calcutta by the Bengal-Nagpur, East Indian, Eastern Bengal and Darjeeling-Himalayan Railways, all to places within a day's journey. I found it barely credible that places so near to Calcutta as Jamalpur were getting their sea-fish from Bombay. A regular daily parcel service should be inaugurated to such places as Darjeeling, Kurseong, Dacca, Monghyr, Jamalpur, Ranigang, Asansol, Burdwan, Bhagalpur, Adra and Purulia.

In Bengal where well-to-do people of all nationalities make their purchases through their Khansamahs bearer, the question of dustoorie (discount) must be faced. The Golden Crown Stall at the New Market was boycotted by Khansamahs who won't buy and the bawarchi (cook) won't cook the fish there is little or no prospect of developing a fish trade. A prejudiced bawarchi will purposely spoil good fish through bad cleaning and cooking. So allowance must be made for dustoorie.

The questions of packing and transport can hardly be dealt with here. They are likely to afford greater difficulties than in a cool country like England; but Indian railway management is enterprising and there can be little doubt that any transport difficulties would be overcome. Ice would have to be freely employed.

For many years to come the best way to develop the fish-supply of Bengal will be by way of improving the local fisheries and not by steam trawling in the Bay. For the Calcutta Market there are three main sources of supply which have hardly been developed at all by modern methods, the chief of which is improvement of transport.

The three supply districts for the Calcutta Market are:—

1. Puri with Balasore;
2. Lake Chilka;
3. The Sundarbans. (*a*) Khulna, (*b*) Port Canning (Matla), (*c*) Diamond Harbour. At special seasons other places would yield a supply, *i.e.*, Hilsa from Sara Ghat.

At Puri fish can be purchased cheaply from the Telugus; in my opinion more cheaply than it would cost to catch them with steam trawlers in the Bay. There is a good variety of fish at Puri particularly those most in demand by the European population of Calcutta.

In the cold weather, masula boats are employed; in the monsoon only catamarans can be used. Good fish can be purchased here from Rs. 3 to Rs. 3½ per maund which gives a good margin of profit in Calcutta even after paying for ice and carriage. In the cold weather about 50 large seine nets (burra jal) are in use daily on the beach at Puri; in the monsoon season about 40 catamaran jal. Balasore and Chandipur are also capable of development and here you get the famous hilsa and "topsee-maach". Chandipur is 3 miles from Balasore and connected with it by a pucca road. Balasore is much nearer to Calcutta than either Puri or Balugaon and there is a good train service. Fixed engines (mal jal) can be leased at Chandipur or Parikhi (at the mouth of the Bura Balang) for Rs. 200 per annum. Fish can be purchased from the fishermen from Rs. 2 to Rs. 5 per maund.

Lake Chilka is capable of great expansion as a source of supply to Calcutta. This Lake could be worked from Balugaon, on the Bengal-Nagpur Railway, or even from Kalikotta. Balugaon is about one mile from the landing place at the lake-side and connected therewith by a good road. Satpara is the best place on the Lake for development of a fishing station. What is required above all things on this Lake is a shallow-draft motor-boat capable of taking up to 100 maunds of fish or ice. A motor-boat of this kind could be worked by a serang, mistri and a crew of three or four with coolie labour for the shore work. A boat of this kind could work the whole Lake from Arakhuda to Satpara and thence to Balugaon.

There are about 120 families at Arakhuda with 60 to 70 boats and 100 nets. All the Indian fishermen I met were intelligent men; at any rate as regards fish-catching, a trade they have carried on from father to son for many generations. They can catch the fish. It is the transport and the marketing that are the difficult problems, especially in hot weather. I am satisfied that for many years to come you can buy fish cheaper from the Indian fishermen than you can catch them by European methods; enough at any rate for the Bengal markets. The bara pania fisheries (stake fisheries) of Toa used to be let for Rs. 520.

Finally come the Sundarbans which are capable of enormous development. For the western part of the delta Diamond Harbour is an ideal centre, with a subsidiary base at Fraserganj where stake nets would be profitable especially at spring tides in the cold weather. A motor launch could make the journey from Fraserganj to Diamond Harbour in 4½ hours (the exact time depending on the tide) where there is a train at 11 P.M. for Calcutta. I am certain fish of the highest class such as mullets, bektis and hilsa in the season, can be obtained between Fraserganj and Diamond Harbour. Again at Matla (Port Canning) there is a train in the evening arriving at Calcutta in the early morning. Very fine bektis are obtainable here and fine shrimps and prawns at Kaligang. A good supply of fish can be depended upon from mid-August to March, just at the time when prime fish is in most demand.

Another good centre with train service to Calcutta is Khulna, from which Bagherat, Morrelganj and fishing stations at the mouths of the Bungarah and Pussur rivers could be worked by means of motor launches. The mouths of these rivers are regularly visited by men from Chittagong, who come to catch fish during the cold weather. These men dry the fish and take it home at the end of the season. This trade could easily be diverted to the Calcutta market. At Bagherat and Morrelganj the chief fish are topsee-maach, bekti, pangash, tengra and chingris. Large quantities of dried chingris are exported from these districts.

To sum up; in my opinion no Japanese or other steam trawling company working in the Bay of Bengal with headquarters at Calcutta could hope to compete successfully with a company prepared to develop and utilise the local fisheries carried on by Indian fishermen; provided the two main difficulties are overcome and these are, as indicated, rapid transport and proper preservation of the fish until it reaches the consumer.

The fish-eating public in Bengal is not accustomed to the taste of sea-fish. Fresh-water and eastuarine fish are much preferred and fortunately there are very excellent species of both descriptions available in abundance. In the above I have mainly dealt with what may be called a high-class trade, but it must not be forgotten that there is an overwhelming supply of what, without prejudice, may be called coarser fish such as Siluroids, Gobies, etc., which would find a ready and profitable sale to the less wealthy sections of the population.

Calcareous Algae from the Inter-Trappean Beds Near Rajahmundry.

By S. R. Narayana Rao, K. Sripada Rao
(*University of Mysore*)
and
Julius Pia
(*Natural History Museum, Vienna, Austria*).

AS already stated in previous notes (N. Rao and S. Rao, 1935; R. Rao, N. Rao and S. Rao, 1936) the Rajahmundry-limestones —marine and estuarine intercalations in the Lower Deccan Traps of the Godavari coastal region—contain numerous fragmentary remains of calcareous algæ belonging to the families Characeæ and Dasycladaceæ. Some of the Characeæ have been listed in the above-mentioned papers. Now we are in a position to give a provisional list of the Dasycladaceæ.

Names of the algæ	Stratigraphic range of the genera					
	Triassic	Jurassic	Cretaceous	Paleogene	Neogene	Recent
Holosporella cf. *siamensis* Pia ..	?	..	..	..	..	..
Dissocladella ? sp. ..	..	..	+	+	..	..
Neomeris 4 spp. ind. ..	..	..	+	+	+	+
Terquemella lenticularis n. sp. ..	..	?	?	+	..	..
Acicularia sp. ..	..	..	?	+	+	+
Acetabularia ? sp. ..	..	..	..	+	..	+
Dasycladaceæ indet. ..	..	..	..	..	..	..
Characeæ indet. ..	..	..	..	..	..	..

We have already referred to the unexpected discovery of *Holosporella* in another note (N. Rao and S. Rao, 1937). This genus was first described from rocks supposed to be Triassic, exposed near the Burmo-Siamese frontier (Pia, 1930). We do not think it safe to draw any stratigraphical conclusions from its occurrence in the Rajahmundry-limestones. The age of the original finds in Siam may not be fixed beyond every doubt. Besides, the identification of Dasycladaceæ in which only the sporangia are calcified is not as exact as in other genera. In any case, the survival of so primitive a Dasycladacea into the Tertiary was hardly to be expected.

The single specimen of *Dissocladella* ? is very poorly preserved. It may belong to another genus, *Trinocladus*, *Thyrsoporella*, *Belzungia*. *Dissocladella* itself is known from Cretaceous and from Tertiary strata.

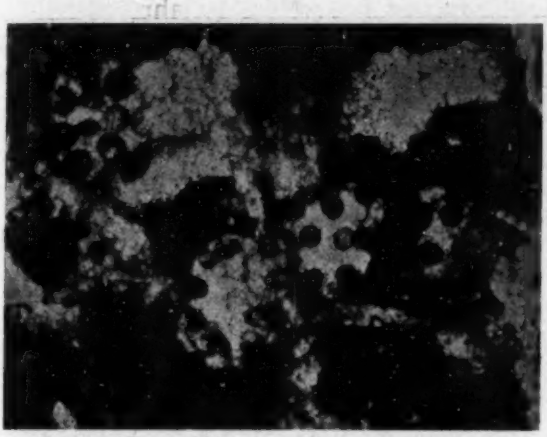
The numerous fragments of *Neomeris* all seem to belong to the section *Descainella*. In this subgenus the calcareous envelope is composed of free annulets each corresponding to the sporangia of a single whorl. It seems impossible to determine such fossils specifically, especially when only observed in slides. Our specimens are comparatively large. *Neomeris* appears first in the Cenomanian and still lives at the present time.

Concerning the identification of *Terquemella*—the commonest alga in our material—the remarks made on *Holosporella* ought to be kept in mind. Calcareous corpuscles with spherical spore-cavities corresponding to the definition of *Terquemella* have been found in Tertiary as well as in Jurassic strata. Very probably they were borne on plants differing rather markedly in the structure of the uncalcified branches. As our specimens belong to a new species, they are of little value in correlating the Rajahmundry-limestones.

The occurrence in our material of a true *Acicularia* with long, needle-like calcareous spicules is perhaps the most important fact from a chronological point of view. This type has never been observed in strata older than Paleocene (except for a very doubtful case; see Pia, 1937). It is found frequently in the Lower Tertiary.

Fossil *Acetabulariæ* are also confined to Tertiary strata. They are, however, exceedingly rare, owing to the very fragile nature of the calcareous incrustation. They have, therefore, not the same stratigraphic value as the *Acicularia*. Their absence from Cretaceous rocks may be an apparent one.

If we put aside for the moment the problematic genus *Holosporella*—out of place in Cretaceous as well as in Tertiary strata—the flora under examination has decidedly



Section of Pungadi-limestone showing accumulation of the remains of *Terquemella lenticularis* sp. nov. × 75

a modern character. This becomes the more evident, when we compare it with the flora of the Danian Niniyur strata of the Trichinopoly district (Rama Rao and Pia, 1936). Here the living genus *Neomeris* is entirely missing. It is replaced by the extinct *Indopolia*. The more primitive genus *Dissocladella*, represented in the Rajahmundry-limestone by a single, doubtful specimen, is fairly common in the Niniyur strata. The *Acicularia* found in them differs markedly by its stout shape from the one mentioned above.

Summing all these facts we may conclude, that the Dasycladaceæ of the Rajahmundry-limestones do not yet supply a sufficient basis for the exact determination of the geologic age. They add, however, markedly to the probability, that the traps of the Rajahmundry area erupted in Tertiary, not in Cretaceous time. Further progress will depend upon the finding of more complete, specifically determinable algal remains in the Rajahmundry-limestone, but even more on the discovery within the tropical regions of other comparable algal floras in rocks of precisely known age.

A fuller description of the Rajahmundry Dasycladaceæ, with plates, will be shortly published in the Proceedings (*Sitzungsberichte*) of the Vienna Academy of Science.

December 8, 1937.

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—, "*Holosporella* cf. *H. siamensis* Pia, from the Rajahmundry limestones," *Rec. Geol. Surv. Ind., Calcutta*, 1937, **71**, Part 4.

Pia, J., "Upper Triassic fossils from the Burmo-Siamese Frontier.—A new Dasycladacea, *Holosporella siamensis* nov. gen., nov. sp., rom. etc.," *ibid.*, 1930, **63**, 177.

—, "Sammelbericht über fossile Algen: Dasycladaceæ 1928 bis 1936, mit Nachträgen aus früheren Jahren."—*Neues Jahrb. f. Min. usw.*, Stuttgart, 1937. III, 1020.

Rama Rao, L., Narayana Rao, S. R., and Sripada Rao, K., "On the age of the Deccan Traps near Rajahmundry," *Proc. Ind. Acad. Sci.*, Bangalore, 1936. **3**, No. 2, 157.

Rama Rao, L., and Pia, J., "Fossil algæ from the Uppermost Cretaceous beds (the Niniyur Group) of the Trichinopoly District, South India," *Pal. Ind.*, N.S., Calcutta, **21**, mem. 4.

Element 87.

THE discovery of element number 87—the last but one of the missing elements in the periodic table—has been made in France. The findng of this elusive element, whose discovery has been previously reported and afterwards disproved, was made by Horia Hulubei, in France.

The discovery has not yet been reported in scientific journals but was discussed by Dr. F. R. Hirsh, Jr., research fellow at the California Institute of Technology, speaking at a seminar of the physics department. Dr. Hirsh reported that Hulubei's discovery was made as a result of a suggestion of Dr. Jesse W. M. DuMond, research associate at the institute. In 1930 Dr. DuMond first suggested an apparatus, known as the curved crystal focussing spectrograph, which was modified by M. Cauchois and used by Hulubei in the discovery of element number 87.

While at Cornell University Dr. Hirsh, one of the 17 or 18 investigators who sought the formerly missing element, reported to the American Physical Society that he was unable to confirm a prior claim by Professor Jacob Papish and Eugene Wainer, for the discovery of the element. Dr. Hirsh predicted that the last missing element, number 85 in the periodic table, might be discovered by the powerful instrument used in France. This instrument is so sensitive that it can detect one part of a given element in 10,000,000,000 parts of polluciate or any chemical or mineral. Polluciate is the mineral in which Hulubei discovered element number 87, and which he has named madavium. The only remaining missing element is ekaiodine.—*Science*, 1937, 86, 223?, pp. 10 (Supplement).

LETTERS TO THE EDITOR.

PAGE

The Nature of Lattice Oscillations in Solid Carbon Dioxide. By C. S. VENKATESWARAN. 378

Colour Measurement on Natural Cotton. By R. B. FORSTER AND B. K. VAIDYA .. 379

Determination of Atebrin in Urine by the Pulfrich Photometer. By N. K. IYENGAR AND B. MUKERJI 381

Disulphur Oxide. By B. SANJIVA RAO .. 381

The Colour of the Blue Quartz of the Charnockites of South India and of the Opalescent Quartz-Gneiss of Mysore. By N. JAYARAMAN. 381

PAGE

A Preliminary Note on Polystely in Limnanthemum cristatum *and* Ottelia alismoides. By G. P. MAJUMDAR 383

The Development of the Sporocarp in Salvinia *sp.* By J. V. DESHPANDE 385

Testing Laboratory Experiments: Water-Cement Ratio in Cement Concrete. By D. S. VENKANNA AND R. SRINIVASAN .. 386

Eupelmus tachardiæ, *How., and the Lac Insect.* By P. S. NEGI AND S. N. GUPTA 387

The Distribution of the Mean Fisher's t^2. By P. V. KRISHNAIER 392

The Nature of Lattice Oscillations in Solid Carbon Dioxide.

IN a letter to *Current Science*, Sirkar and Gupta[1] have reported that the wing accompanying the Rayleigh line in gaseous carbon dioxide is replaced by an intense Raman line with $\Delta\nu = 58$ cm.$^{-1}$ in the solid state. This result is very significant in deciding the probable origin of low frequency oscillations in solids. According to the latter authors, the lattice of a cubic crystal cannot give rise to an intense line in the Raman effect and therefore, they have concluded that this new line in CO_2 has to be attributed to 'inter-molecular oscillations in loosely polymerised groups formed at the low temperatures'. In the numerous publications of Sirkar[2] on this subject he has not indicated what is precisely meant by 'polymerisation'. If he means an association of two or more molecules, as in formic acid or water, brought about by a chemical bond which is much stronger than the usual inter-molecular linkage in a crystal, the existence of such groups of dimers or polymers will be revealed by X-ray or electron diffraction studies. The available crystal structure data of CO_2, CS_2 or CCl_4 in which such lines have been reported do not lend evidence to this view. If, however, Sirkar means by 'inter-molecular oscillations of polymerised groups,' only an oscillation of a certain set of molecules against another in the lattice, it is the same as the lattice oscillations in the crystal.

Solid CO_2 being a cubic crystal, the frequency of oscillation characteristic of its lattice could be calculated from the Lindemann[3] expression $\omega = CR^{\frac{1}{2}} N^{\frac{1}{3}} \sqrt{T_m/M}\, V^{\frac{1}{3}}$, where $C = 2{\cdot}75$, $R^{\frac{1}{2}}N^{\frac{1}{3}} = 0{\cdot}77 \times 10^{12}$ units for cubic crystals, T_m is the melting point, M is the molecular weight and V is the molecular volume of the substance. For CO_2, M = 44, V at $-56°{\cdot}6$ C. = 28·21, and $T_m = 216°$ A. This gives $\omega = 1{\cdot}54 \times 10^{12}$ vibrations per second or $\Delta\nu = 51{\cdot}5$ cm.$^{-1}$ This result agrees well with the observed Raman line at 58 cm.$^{-1}$ and indicates that the Raman line is intimately connected with the oscillations of the crystal lattice. A similar agreement between the calculated and the observed Raman shift has been previously reported by me for phosphorus.[4]

Two important facts connected with these low frequencies, however, require explanation, namely, (1) they are generally very intense only in anisotropic molecules; (in compounds like cyclohexane and phosphorous trichloride they have not been observed[5]), and (2) they are either completely depolarised or appear as a broad band in the liquid state, which is completely depolarised ($\rho = \frac{6}{7}$). These two facts are satisfactorily explained on the basis of the hypothesis put forward

by Bhagavantam[6] that these lines are due to hindered rotation of individual molecules in the crystal lattice. In the case of the cubic crystals of CO_2, this frequency of *rotational oscillation* could be calculated according to the method of Pauling.[7] Thus, the absolute temperature at which the heat capacity of CO_2 is 5 cal./mol. per degree is 122°·4 A.[8] This is equal to $h\nu_0/k$ or $(hc/k)\ \Delta\nu$, where $\Delta\nu$ is the oscillational frequency in cm.$^{-1}$ hc/k is the well-known radiation constant, equal to 1·4317 and therefore, $\Delta\nu = 82{\cdot}5$ cm.$^{-1}$ The agreement between this value and the experimental frequency is not so good as is the case with lattice frequency; but considering the approximations involved in the above calculation, they may be considered as of the same order of magnitude.

This correspondence between the observed and the calculated lattice frequency on the one hand and the frequency of rotational oscillations on the other, suggest that these two modes of oscillation of molecules in a crystal are *interdependent*. The lattice oscillation in the crystal is probably not one in which one group of molecules vibrates against another as in a valence oscillation, (which we may call 'symmetric oscillations'), but one akin to flextural oscillations of the crystal in which two systems of molecules execute rotational oscillations against each other. In the case of a simple cubic crystal, this latter kind of oscillation may be illustrated as in Fig. 1. In this oscillation we assume

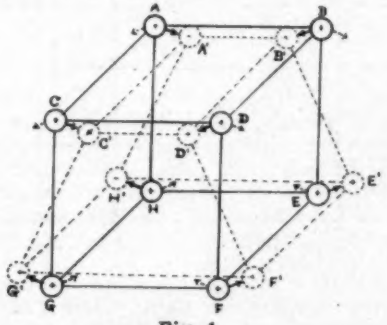


Fig. 1.

Showing flextural oscillations in a cubic crystal. The circles represent molecules, the arrows indicate rotational oscillations of the molecules and the dotted lines show the relative positions of two opposite molecular planes during an oscillation.

that each individual molecule executes a rotational vibration along with its neighbours. The following characteristic of the flextural oscillations of the lattice may be qualitatively deduced:—(1) The frequency of this oscillation will be approximately the same as but always less than the frequency of hindered rotation of the individual molecule, a fact which is verified by the data given above.* (2) Unlike the 'symmetric oscillations of the lattice,' this flextural oscillation involves an asymmetric restoring force and is, therefore, favourable for exciting intense Raman lines. (3) The Raman lines arising from these oscillations will be completely depolarised. (4) Their intensity will be determined by the anisotropy of the molecule. (5) As melting sets in, this flextural or tipping oscillation of the crystal involving rotational oscillations of the molecules will tend to be replaced by the complete rotation of molecules themselves, and will give rise to the 'wing'. The relative intensities of these lines due to the crystal and the vibrational lines of the molecule remain to be worked out theoretically.

C. S. VENKATESWARAN.

Physics Department,
Indian Institute of Science,
Bangalore,
January 31, 1938.

[1] Sirkar, S. C., and Gupta, J., *Curr. Sci.*, 1937, **6**, 21.

[2] —, *Ind. Jour. Phys.*, 1937, **11**, 343; **10**, 109 and 189, etc.

[3] Lindemann, F. A., *Phys. Zeit.*, 1910, **11**, 609; see also Gruneisen, E., *Ann. der Phys.*, 1912, **39**, 257.

[4] Venkateswaran, C. S., *Proc. Ind. Acad. Sci.*, (A), 1936, **4**, 414.

[5] Sidorova, A., *Acta. Phys. Chem.*, U.R.S.S., 1937, **7**, 193; Sirkar, S. C., and Gupta, J., *Ind. Jour. Phys.*, 1937, **11**, 55.

[6] Bhagavantam, S., *Proc. Ind. Acad. Sci.*, (A), 1935, **2**, 63.

[7] Pauling, L., *Phys. Rev.*, 1930, **36**, 430.

[8] *International Critical Tables*, **5**, 86.

* A similar lowering of the oscillational frequency has been observed for nitrogen (see Pauling, L., *loc. cit.*).

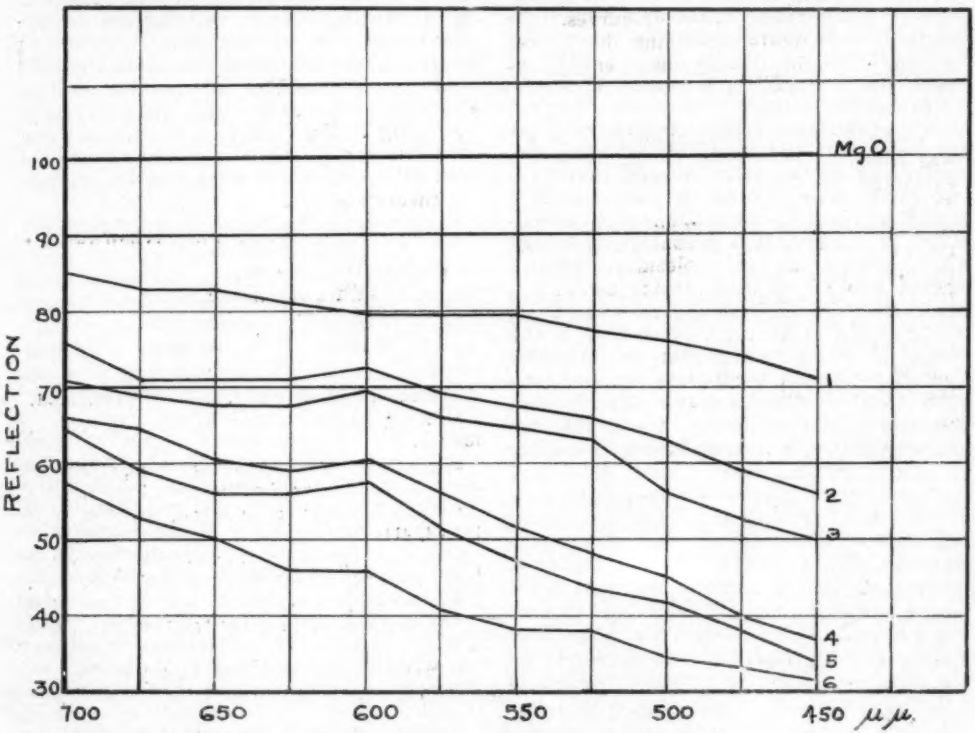
Colour Measurement on Natural Cotton.

WE had recently an opportunity of examining six samples of natural cotton which ranged in colour from white to brown. The samples were reported to be confirming to the Lint Colour Standards I–VI and were designated as follows:—

Sample No.	Standard	Name
1	Lint Colour Standard I	K-546
2	,, II	Comilla
3	,, III	A Segregate
4	,, IV	Nanking
5	,, V	Buri Khaki
6	,, VI	

The reflection of light incident at an angle of 45° and viewed at right angle to the surface of the sample, was compared on a visual spectrophotometer with a standard white surface of magnesium oxide, the light source being a 500 watts Osram projection lamp. Reflection curves given in Fig. 1, show quantitatively the increase in the depth of colour from sample 1 to 6. It would be seen that the whitest sample examined (No. 1) reflects on the average 80 per cent. of the light reflected by magnesium oxide, while its deficiency in blue-green and blue colour is obvious. In the rest of the samples the quantity of grey and deficiency in blue increase giving them a brown appearance.

Incidentally, it may be observed here, that the colour measurement of nearly white surfaces is of great importance in textile industry for the assessment of bleached goods. In such cases the visual spectrophotometric method mentioned above would appear to form a useful addition to the methods employing light filters and a photo-electric cell.



R. B. FORSTER.
B. K. VAIDYA.
Optics Laboratory,
Department of Chemical Technology,
University of Bombay,
Bombay.
February 5, 1938.

Determination of Atebrin in Urine by the Pulfrich Photometer.

THE Zeiss Pulfrich Photometer has been employed for the estimation of atebrin in urine. The absorption curve of a 0·02 per cent. solution of atebrin in N/10 HCl is determined by a series of measurements of transmission, employing all spectral filters in succession. The absorption has been found to be maximum with S/43. This filter has been used for the measurement of the extinction co-efficient. The concentration of the solution was found proportional to the extinction coefficient and the Lambert-Beer absorption law is valid, obviating the necessity for the calibration curves. The conversion factor for obtaining the concentration of atebrin in mgms. per 100 c.c. from the observed extinction co-efficient is 5·49.

An accurately weighed amount of atebrin was added to 200 c.c. urine. The urine was extracted for atebrin by the method of Tropp and Weise,[1] the final acid extract, thus obtained, was made upto 100 cc. and the extinction coefficient was determined in the Photometer, using a cell of stratum thickness of 1 mm. The concentration of atebrin was obtained by multiplying the extinction co-efficient by the factor 5·49.

The accuracy may be judged by the following results obtained in our experiments:

Atebrin added	Atebrin found	Percentage error
29·3 mg./100 c.c.	28·7 mg./100 c.c.	2·05
12·2 mg./100 c.c.	11·9 mg./100 c.c.	2·54

This is a much quicker method than the colorimetric method usually employed for such determinations. This method further obviates the necessity for preparing standard solutions for every determination.

N. K. IYENGAR.
B. MUKERJI.

Biochemical Standardisation Laboratory,
All-India Institute of Hygiene and Public Health, Calcutta,
January 13, 1938.

[1] Tropp and Weise, *Arch. Exp. Path. u. Pharmak.*, **1933, 170, 339.**

Disulphur Oxide.

AT the recent session of the Indian Science Congress, Calcutta, I pointed out that disulphur oxide (S_2O) appears to be the primary product of the hydrolysis of sulphur chloride. Since then further work has been done in this laboratory to prove the existence of disulphur oxide in the yellow solution obtained when sulphur monoxide is passed into dry carbon tetrachloride kept at −12° C. I now have conclusive experimental evidence to show that disulphur oxide does exist. The oxide in carbon tetrachloride solution, reacts with dilute caustic soda producing the sulphide and the sulphite of sodium in equimolecular proportions. It decomposes fairly rapidly into sulphur and sulphurdioxide.

$$2S_2O \cdots 3S + SO_2.$$

The oxide (in carbon tetrachloride solution) is more stable in presence of dry hydrogen chloride.

B. SANJIVA RAO.

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Central College, University of Mysore, Bangalore,
February 14, 1938.

The Colour of the Blue Quartz of the Charnockites of South India and of the Opalescent Quartz-Gneiss of Mysore.

HOLLAND[1] investigated the greyish blue charnockite quartz of South India and observed the presence of acicular inclusions which he considered to be rutile. He reported that the colour of the quartz was probably due to those inclusions but he does not appear to have either isolated the inclusions or carried out a chemical investigation of the quartz specimens.

Specimens of the charnockite quartz with varying intensity of blue colour as well as of blue quartz from the opalescent quartz-gneiss of Kadur District (Mysore) were examined in the course of this work, both microscopically and chemically. The colour of these quartzes which is of an yellowish tone by transmitted light and blue by reflected light was found to be greatly affected by heating the charnockite quartz losing its colour completely even at 300°.

Thin sections of these quartzes show under the microscope a large number of inclusions which can be classified under two heads,

(*a*) regularly arranged acicular inclusions (*Microphotograph* 1) and (*b*) the more or less drop-like and dust-like inclusions which show large variations in size and are often arranged similar to chains of beads (*Microphotograph* 2). The quartz grains appear under the microscope to be built up of many crystal grains in different orientations, and also exhibit wavy extinction. The acicular inclusions often extend into adjacent fragments of the quartz in unbroken continuity thereby indicating either a secondary origin or a secondary arrangement.

Fig. 1.

Blue quartz "B" with the acicular and dust-like inclusions—in transmitted light. × 200

Fig. 2.

Blue quartz "B" with the dust-like and drop-like inclusions—in transmitted light. × 600

All the coloured quartzes show under the microscope a pale brownish-yellow turbidity, the intensity of which was found to vary with the intensity of the blue colour in the specimens. This turbidity is destroyed by heat in the same way as the blue colour.

This brownish-yellow turbidity was not noticeable in the colourless quartz from Pallavaram (Madras) obtained close to the charnockite masses, and which also contained acicular inclusions similar to those in the blue quartz. Another colourless quartz obtained from Bodi-Charnockite (Madura) contained drop-like and dust-like inclusions, but did not reveal the presence either of acicular inclusions or of the brownish-yellow turbid medium. These observations show that neither of these kinds of inclusions is responsible for the blue colour, and that the brownish-yellow turbid medium is observed only in the coloured specimens and not in others.

Boiling with hydrochloric acid freed the crushed specimens from the iron present as an impurity, but since the blue colour of the specimen persisted even after this treatment, it is evident that iron compounds do not contribute to the colour of the specimen.

The acicular inclusions were separated from the quartz by the method recently proposed by Postelmann[3] and were found to be very fine needles of rutile. Chemical analysis revealed that all the quartzes examined contained significant amounts of titanium, the titanium contents of the specimens being proportional to the depth of colour.

The quantity of rutile present in the specimens was estimated microscopically and found to be roughly the same even in specimens of different intensities of colour. Since chemical analyses revealed, however, that the intensity of colour was proportional to the titanium content of the specimen, it follows that the specimens contained titanium not only as tutile but also in some other non-crystalline form. This deduction is justified by the discovery of (1) the brownish-yellow turbid medium referred to already in all the coloured specimens, (2) the destruction of this turbidity and the accompanying loss of colour on heating.

It can therefore be stated in conclusion that the colour of the specimens of quartz examined appears to be due almost entirely to the existence of a brownish-yellow turbid medium, which contains titanium

in a colloidal condition. Further work on this problem is in progress and full details will be published elsewhere.

The author wishes to thank Dr. K. R. Krishnaswami for his keen interest in the work.

N. JAYARAMAN.

Department of General Chemistry,
Indian Institute of Science,
Bangalore,
February 2, 1938.

[1] *Mem. Geol. Surv. India*, 1900, **28**, 2.

[2] *Neues Jb. Mineral. Geol. Palaeon.*, 1937, **Bd.72**, Abt. A, 401.

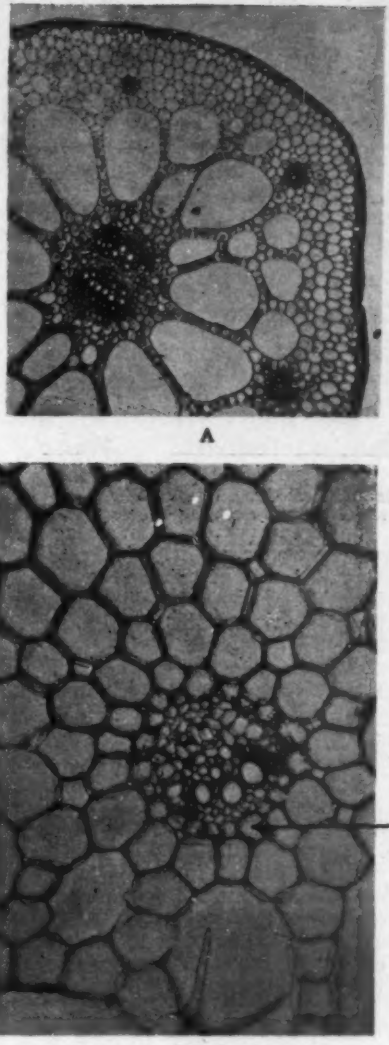
A Preliminary Note on Polystely in *Limnanthemum cristatum* and *Ottelia alismoides*.

Limnanthemum cristatum is an aquatic herb common in fresh-water jhils, ponds, etc., all over Bengal. Its shoot morphology has been studied by d' Almeida.[1] Polystely occurs in the cortical region of the stolons and in the petioles of the leaves arising on the stolons. The stolons, but for their axillary position, the inflorescence borne on them, the short-petioled floating leaf and the absence of a pair of stipules at the base, very much resemble the long-petioled floating leaves. It belongs to the N. O. Gentianaceæ.

Ottelia alismoides is also an aquatic herb very common in fresh-water jhils, ponds, etc., in Bengal. Its submerged leaves are narrow but the floating leaves are long-petioled, ovate-lanceolate, oblong or cordate. The peduncles are also elongated. All the bundles of the peduncle and the leaf-stalk are individual steles. It belongs to N. O. Hydrocharitaceæ.

The cortical steles of *Limnanthemum* have each an endodermis surrounding it without a clearly distinguishable pericycle, while the steles of *Ottelia* have both endodermis and pericycle surrounding each of them. The endodermal cells in the former case have well-developed Casparian strips (made out with phloroglucin and hydrochloric acid), and in both the cases they are characterized by the presence of falling starch grains.

The question now arises: Should we call these discrete vascular bundles, steles? Solereder[2] has described these structures in

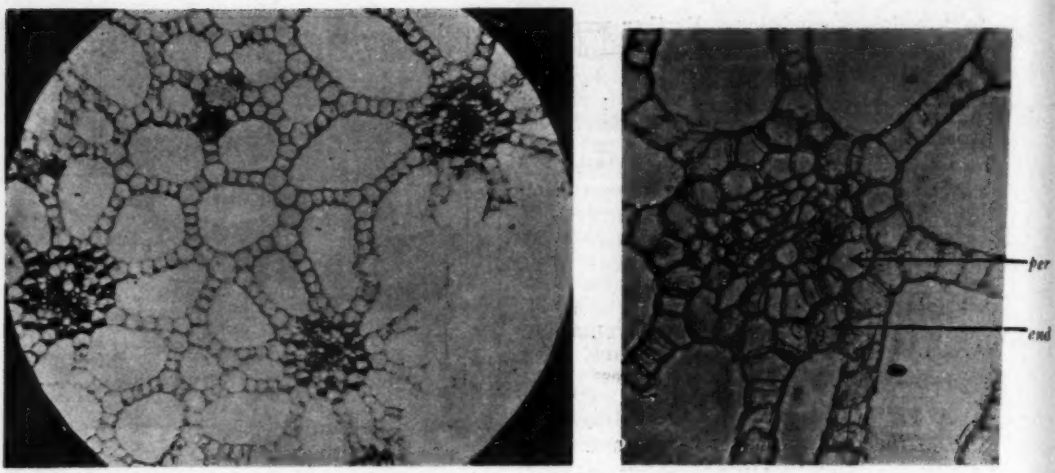


A

B

Limnanthemum cristatum. A-photomicrograph of a *t. s.* of stem, showing central and cortical steles; B-that of a cortical stele magnified. *end*, starch-sheath with Casparian strips.

a *Limnanthemum* spp. as a ring of isolated vascular bundles surrounded by starch sheath. Similar bundles in *Leiphaimos* have been described by Johow[3] as 'perhaps of the nature of steles'.



A B

Ottelia alismoides. A–photomicrograph of a *t. s.* of stem showing scattered arrangement of steles; B–that of a stele magnified. *end.* starch-sheath; *per*, pericycle; starch grains in A stained black with iodine solution.

Van Tieghem has defined a 'stele' as the central cylinder of xylem and phlœm surrounded by the cortex (stele = a column). Strasburger[4] characterizes the layer of cortex surrounding a stele as always containing starch grains. He says that "differentiated as a starch sheath, the phlæoterma (= endodermis in roots) is rendered conspicuous by the quantity of movable starch contained in its cells". Jeffrey,[5] Eames and Mc Daniels[6] have apparently accepted this definition of the stele. This definition is adhered to by Haberlandt when he says "the primitive axile conducting strand of the stem, delimited from the surrounding cortical tissue by an endodermis may be regarded as the first stage in the evolution of the structures known as the central cylinder or stele." Solereder[7] refuses to accept as steles vascular bundles without any endodermis.

We may, therefore, take it that the presence of a starch sheath or an endodermis is the criterion for distinguishing a stele from a simple vascular bundle. On this criterion polystely has been observed in a number of Angiosperms, such as, *Auriculas*, *Gunnera*, *Hottonia*, *Pinguicula*, *Victoria regia*, *Castalia*, *Cabomba* and others.[8]

Polystely, so far as the Angiosperms are concerned, has been observed only in the aquatic species with the exception of a species of Pinguicula which however is related to the aquatic Utricularias. These facts led Scott[10] to speculate on the origin of polystely in Dicotyledons and he suggested that the polystelic condition observed in these plants might be regarded as the anatomical expression of the renewed adoption of the terrestrial habit. Or in other words, he means to say that formerly the ancestors of these plants were terrestrial and like the normal dicotyledonous plants had secondary growth by Cambium. When, however, they took to the aquatic life their vascular system was very much reduced (*cf.* "Law of Loss"—A. Arber). For some unknown reason or circumstances these plants changed their habitat and returned to the terrestrial mode of life. The reduced vascular system was then found to be inadequate and the deficiency was compensated for "by increasing the number of steles rather than the size of the single central cylinder". Agnes Arber[11] has accepted this explanation and Prankerd[12] does so with some reservation when he says, "an aquatic ancestral existence is the origin of at least some, if not all, cases of polystely in Dicotyledon."

Polystely, if we are still to use this term, is common in Cryptogams. But it is not known with certainty if they have descended from aquatic ancestors. Even tree ferns, which in the ordinary course should have a provision for secondary growth, have this structure. Regular secondary growth takes

place in the rhizome of *Limnanthemum*, and *Ottelia* is a mono-cotyledon with the usual scattered arrangements of vascular bundles. How can one then accept the theory of renewed terrestrial habit to explain the origin of polystely in the Dicotyledons only when the same theory cannot explain its origin in the vascular Cryptogams and the mono-cotyledons?

Polystelic condition is undoubtedly a means to an end, that is, to increase the means of transport (conducting tissue) in the absence of a provision for secondary growth. In our cases it is found in, more or less, temporary and floating organs. In them secondary growth in thickness (*cf.* "Principle of Maximum Efficiency"—Haberlandt) would be rather a waste of energy and material. The plants are perennial, the leaves are very large and the assimilate is proportionately larger.

It, therefore, appears reasonable that these bundle-steles, or the polystelic condition found in the otherwise normal plants owes its origin to the greater need of transport of food materials and not in response to renewed terrestrial habit as Scott and Arber and Prankerd too, would have us believe. Or the term 'Stele' may be retained only for the vascular system occupying the centre of the stem, and others may be regarded as vascular bundles with a parenchymatous sheath secondarily used as a temporary store-house for starch.

G. P. MAJUMDAR.

Botany Deparment,
Presidency College,
Calcutta,
January 21, 1938.

[1] *Jour. Ind. Bot. Soc.*, **7**, 1, 1-3.
[2] *Systematic Plant Anatomy of the Dicotyledons*, **1**, 550.
[3] *Ibid.*, **1**, p. 550 (quoted).
[4] *Text-Book of Botany* (Eng ed., 1908), p. 117.
[5] *Anatomy of Woody Plants*, 1917, 162, 278.
[6] *An Introduction to Plant Anatomy*, 1925, p. 338.
[7] *Physiological Plant Anatomy* (Eng. ed.), p. 359; see also p. 386.
[8] *Systematic Anatomy of the Dicotyledons*, **2**, 1157, where he says these are not steles "among other reasons because of the absence of an endodermis around the individual bundles".
[9] *Ibid.*, **2**, 1157, 1159; *Transactions Linn. Soc.*, Ser II, 1897, **5**-vii, 287-99; Agnes Arber, *Water Plants*, 1920.
[10] "Origin of Polystely in Dicotyledons," *Annals of Botany*, **5**, (1890-91), 314-17.
[11] *Water Plants*, **5**, 1920, Ch. XIII, 181-82.
[12] "On the structure and biology of the Genus *Hottonia*," *Annals of Botany*, **25**, 265.

The Development of the Sporocarp in *Salvinia* sp.

Salvinia is one of those plants that are not found in the Bombay Presidency. The present species was borrowed from the Sibpur Gardens, Calcutta, some years back and at present it is growing quite luxuriantly in the Fergusson College Garden tanks.

Of the 13 species of Salvinia described by Baker,[1] only two are found in India—*S. natans* and *S. cucullata*. The occurrence of sporocarps has been noticed only in four species of which *S. natans* is one, and it is this species on which most of the past work has been carried out. According to Baker's *Fern Allies* the present species appears to be *S. cucullata*. The reproductive organs have not been reported to have been found in this species. The author, however, has been able to detect the sporocarps in this species and also has worked out the development of the same in detail, the account of which is given below.

The ventral leaf is dissected from the very beginning into a number of root-like segments. Of these the central segment (possibly this represents the apical part of the leaf) produces alternately as many as fifteen brownish black sporocarps acropetally. Of these sporocarps the basal two are megasporocarps while the remaining ones are the micro-sporocarps. But cases are not rare where the fertile segment bears the two megasporocarps only, the microsporocarps being undeveloped. The megasporocarps can be distinguished from the micro ones by their size, form and position. The megasporocarp is fusiform and is slightly flattened while the microsporocarp is more or less ovate. The megasporocarps are a bit longer (3 mm.) than the microsporocarps (2 mm.) while in their thickness (1·5 mm.) they are alike. In each megasporocarp fifteen to twenty megasporangia are produced from a cushion-like placenta, while in the microsporocarp there are about 150 to 200 microsporangia. Each megasporangium has a thick stalk and only one megaspore, whereas the microsporangium has a long slender stalk and normally 64 spores.

Each sporocarp is developed from a marginal cell, which is cut off from the growing point of the fertile segment referred to above. This initial cell is two-sided and cuts alternately two rows of segments, thus

forming a small protuberance which, later on, develops into a placenta. From the base of this placental protuberance is given out a circular outgrowth which afterwards forms the wall of the sporocarp.

The development of the mega and microsporangia is like that of the leptosporangiate type. There is a single layer of tapetal cells in both the sporangia. In microsporangium there are 16 spore mother-cells producing 64 spores while in megasporangium there are only 8 spore mother-cells which form 8 tetrads but ultimately only one megaspore develops in each sporangium.

The germination of the spores and the formation of the gametophytes are being worked out.

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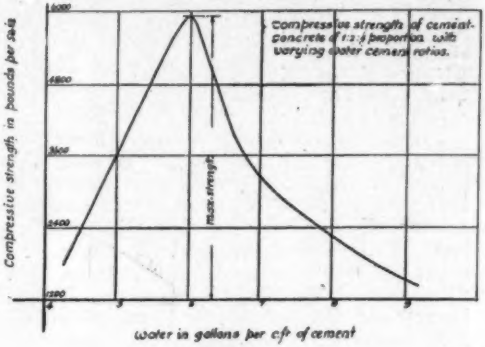
Fergusson College,
Poona,
October 24, 1937.

Testing Laboratory Experiments: Water-Cement Ratio in Cement Concrete.

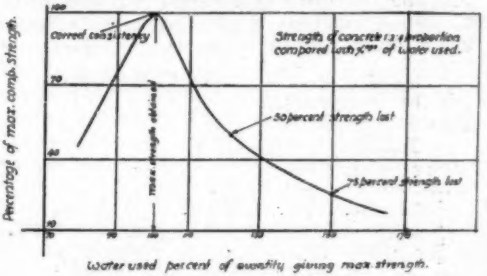
INTERESTING experiments as regards the influence of water-cement ratio on the strength of cement concrete have been conducted in the Materials Testing Laboratory of the Engineering College, Bangalore. It is found from a large number of tests conducted on cement concrete cubes, that the strength of cement concrete depends upon many factors, such as the type of cement, the quantity of cement, the water-cement ratio, the type, quantity and grading of the aggregate and the conditions of curing and hardening. Of these factors the water-cement ratio plays a very important part in determining the strength of cement concrete which is not sufficiently recognised in practice. Keeping the other factors constant there is a particular water-cement ratio which gives the maximum strength. In the case of 1 : 2 : 4 cement concrete, which is generally used in all reinforced concrete construction, it is observed from experiments conducted, that any variation of water either below or above the optimum value for a particular Fineness Modulus of the aggregate, reduces the strength considerably.

It is seen from Graph 1 that 6 gallons of water per cubic foot of cement or a water-cement ratio of 0·67, gives the maximum compressive strength of 5940 lbs. per square inch on a 4 inch. cube of concrete of 1 : 2 : 4 proportion at the end of 7 weeks the Fineness Modulus of aggregate being 5.


Compressive strength of cement-concrete of 1:2:4 proportion with varying water cement ratios.
max. strength
Compressive strength in pounds per sq.in
Water in gallons per c/ft of cement

Graph 1.

Even a small variation of water of 15 per cent to 20 per cent decreases the strength by nearly 50 per cent. It is therefore of utmost importance that correct proportioning of water to cement in cement concrete work should be strictly adhered to. The above water-cement ratio of 0·67 gives proper working consistency for 1 : 2 : 4 concrete which is neither too wet nor too dry for laying. It gives a slump of $\frac{1}{2}''$ to $\frac{3}{4}''$ and workability number of 115.


correct consistency
max. strength obtained
Strength of concrete in proportion compared with 100% of water used.
50 percent strength lost
75 percent strength lost
Percentage of max. comp. strength
Water used percent of quantity giving max strength.

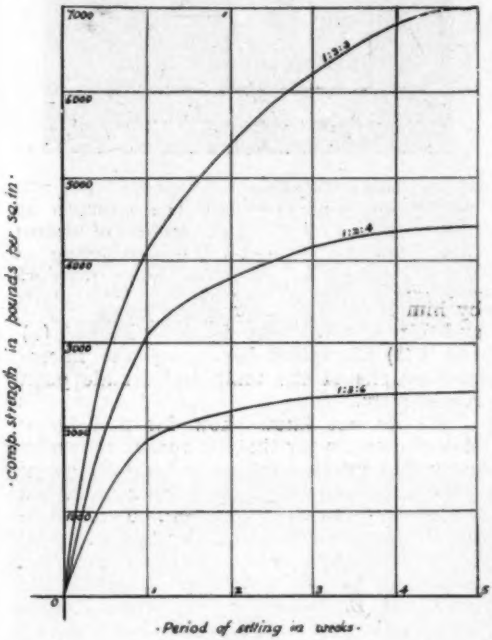
Graph 2.

Graph 2 is drawn to show the percentage variation of the strength of 1 : 2 : 4 cement concrete for various water-cement ratios as compared with the water-cement ratio which gives the maximum strength. The abscissa shows the relative quantity of water used in the mixture, considering the amount which gives the maximum strength as 100 per cent. The ordinate shows the relative strength of the concrete with varying percentage of water as a percentage of the

maximum which can be obtained from the same mixture of concrete.

It is clear from the graph that every ounce of water that is added above that amount necessary to prepare the cementing material, contributes to a reduction in the strength of the concrete. The golden rule which must be followed in order to produce good concrete is never to add more water than is necessary for the use for which the concrete is required.

Using the same water-cement ratio of 0·67 or 6 gallons of water per cubic foot of



Graph 3.

cement, the compressive strength of 4 inch cubes of different grades of cement concrete varying from 1 : 2 : 3 to 1 : 3 : 6 generally used in road pavement, foundations and other works, were tested. Curves drawn in Graph 3 show the relative compressive strengths of different grades of cement concrete for various periods of setting and hardening. It is seen from the time-strength curves that cement concrete increases very rapidly in strength during the first week and keeps on increasing, though at a smaller rate upto 3 months and even up to 6 months. Under ordinary conditions of curing, the compressive strength of 1 : 2 : 4 concrete is seen to be related to its strength at 7 days by the following formula

$$S_{28} = S_7 + 20\sqrt{S_7},$$

where S_7 is the strength at 7 days and S_{28} is the strength at 28 days. The details of tests conducted on cement concrete are published separately.

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R. Srinivasan.

Materials Testing Laboratory,
College of Engineering,
Bangalore,
January 25, 1938.

Eupelmus tachardiae, How., and the Lac Insect.

In spite of our positive proofs and practical suggestions offered to Mahdihassan so that he may satisfy himself in regard to the role of the chalcid *Eupelmus tachardiæ* in lac, he[1] has once again brought forth his so-called convincing proofs in favour of his theory that *E. tachardiæ* is an ectoparasite of *Eublemma amabilis* and not as mentioned by us and Glover an endoparasite of the lac insect and an ectoparasite of *Microbracon greeni* and other insects. We wish to reply only to these basing our remarks on a series of facts both observed and confirmed.

Mahdihassan, while objecting to the illustrations of certain stages of *E. tachardiæ* given by Glover, Negi and Gupta,[2] says, 'I find not a single character distinguishing it (Fig. 1 (*d*) nearly full-fed larva) from that of *Elasmus* or of *Microbracon*'. In this connection we could request the reader to compare our Figure 1*d*, which is about 11 times magnified on page 39 of *Current Science*, Vol. IV, No. 1, to fig. 1 of Mahdihassan which is about 20 times magnified on page 562 of *Current Science*, Vol. III, No. 11, and see if the two figures depict almost identical characters or not. To Mahdihassan, we have only to say that throughout the larval growth the most distinctive character of *E. tachardiæ* which at a glance differentiates it from the larva of *Elasmus* or *Microbracon* or for that matter from any other chalcid or braconid associated with it is the presence of long hairs on its body, and we are surprised that Mahdihassan who claims to know the various

chalcid and braconids found in lac has not been able to notice this conspicuous difference.

In regard to our Fig. 1 (*e*) of the same issue Mahdihassan says, 'I have not come across the prepupal stage of any chalcid I have studied'. Most of the chalcids and braconids associated with the lac insect have a d finite prepupal stage and it is surprising to find such a statement from a person who claims to have made a critical study of these insects. We would further refer Mahdihassan to page 563 of the *Text-Book of Entomology*, by Imms, for the definition of a prepupa and pupa. As for ourselves we call that the prepupal stage which intervenes between the full-fed larva and the pupa, after the former has passed out the meconium, develops the pupal characters and before it casts the larval skin to turn into pupa. It is this stage which was meant to be shown in our Fig. 1(*e*), but as the insect began to cast the larval skin before it could be sketched, we had to kill it with hot water and that is why it

Fig. 1 (*a*).
Microphotograph of Male pupa of *E. tachardiæ*, ventral view. × 34

shows a little too much bend on the abdomen; this, however, does not in any way interfere with any of the characters of the prepupal stage of *E. tachardiæ*.

Mahdihassan further says, 'The small abdomen is distinctly unlike that of *Eupelmus* which I have shown and is illustrated here'. This statement of Mahdihassan shows

Fig. 1 (*b*).
Microphotograph of Female pupa of *E. tachardiæ*, ventral view. × 17

that he is not acquinted with the male *Eupelmus tachardiæ*. Our Fig. 1(*e*) criticised by him is that of male *Eupelmus tachardiæ* and his figure of the female. Figs. 1 (*a*) and 1 (*b*) illustrated here show the microphotographs of the male and female pupa respectively.

We do not know how far it behoves Mahdihassan to say that the cocoon shown by us in Fig. 1 (*a*) is not the cocoon of *M. greeni* and the larva inside it is neither paralysed nor that of *Microbracon greeni*. The cocoon referred to above was spun by the *M. greeni* larva in a glass block and the larva was paralysed by *E. tachardiæ*. Due to the pricks of *E. tachardiæ* the pencil formed between the paralysed *M. greeni* larva and its cocoon is very clearly seen in our Fig. 1 (*a*) and should clearly indicate to any reader that the larva was paralysed. We may further state that the *M. greeni* larva stung by *E. tachardiæ* is not rendered as senseless as the *Eublemma amabilis* larva stung by *M. greeni* and that *E. tachardiæ* generally stings *M. greeni* larva more than twice before it actually oviposits on it. The cocoons shown by Mahdihassan in Fig. 7 are unopened cocoons and spun in lac, and should in a picture naturally look different from the cocoon which has been spun in a glass block and specially when it is partly opened. As a matter of fact the various stages of

Eupelmus tachardiæ shown in Figs. 1 (*a*)–(*e*)[2] are of the *Eupelmus tachardiæ* developed from the eggs shown in Fig. 1 (*b*), and were sketched for reading a paper in the Indian Science Congress Meeting of 1933; and since at present we are chiefly devoting attention to work having direct important bearing on the practical problems of lac cultivation, the work of a theoretical and academic nature on insects which are of little value in the biological control of the lac predators is left unfinished and kept in abeyance. We, however, illustrate in Figs. 2 (*a*), 2 (*b*) and 2 (*c*), *M. greeni* cocoons collected from the field containing *E. tachardiæ* larva and remains of *M. greeni* for the perusal of the reader.

So far we have found *E. tachardiæ* parasitising the lac insect only after the third instar female lac insect has moulted. We have neither said anywhere nor have we yet come across a male lac insect parasitised by *E. tachardiæ* though instances of *E. tachardiæ* parasitising the female lac insect soon after the third moult have been met with, and it was incorrect of Mahdihassan to suggest our having ever said that *E. tachardiæ* was found parasitic on the second instar lac insect. The female lac insect just after the third moult measures about 1 mm. in length. The female *E. tachardiæ* has always been found to develop singly in a female lac insect. Fig. 3 shows the microphotograph of the female pupa of *E. tachardiæ* in a nearly full-grown female lac cell partly opened. Fig. 4 shows a hole in

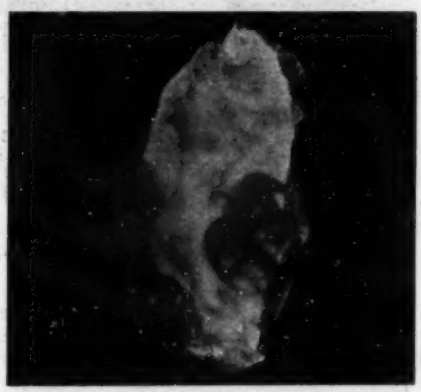

Fig. 2 (*a*).
Microphotograph of *M. greeni* cocoon partly opened showing a portion of *E. tachardiæ* larva and *Eublemma amabilis* pallets. × 17

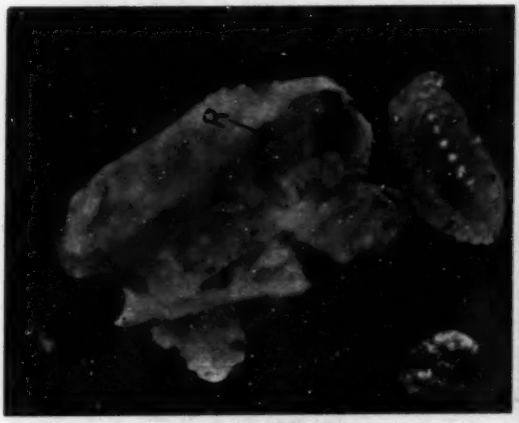

Fig. 2 (*b*).
Microphotograph of cocoon shown in 2 (*a*) opened and *E. tachardiæ* larva taken out. R shows remains of *M. greeni* larva. × 17.

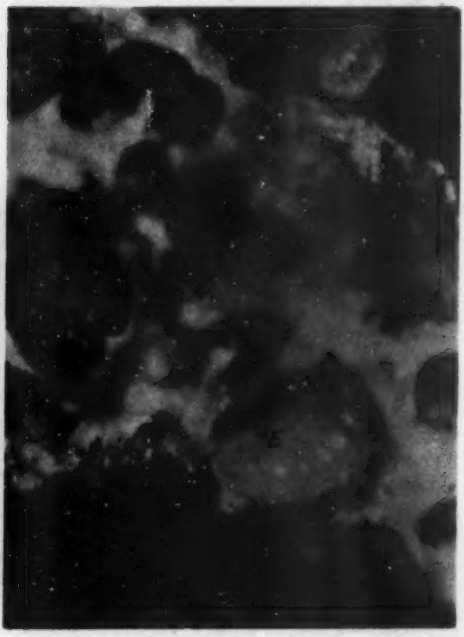

Fig. 2 (*c*).
Microphotograph of a cluster of *M. greeni* cocoons showing *E. tachardiæ* larva E in one of them. × 17

another fully-developed female lac cell by biting which the female *E. tachardiæ* shown in Fig. 5 has come out. The greatest width of the hole made by *E. tachardiæ* shown in Fig. 4 is 0·83 mm. and the width of the head of *E. tachardiæ* is also 0·83 mm. Figs. 6 and 7 show holes made by *Eryncyrtus dewitzi* and *Parechthrodrynius clavicornis* and are given here for comparison with Fig. 4. The holes made by these measure 0·55 mm. and 0·64 mm. respectively.

The male *E. tachardiæ* (Fig. 8) is generally met with parasitic on the larva of the chalcid *Tetrastichus purpureus* and other chalcids enumerated in our previous communications and in nearly full-grown lac females it has been found occurring singly along with 4–5 specimens of other chalcids, specially *Tetrastichus purpureus*. Singly growing almost fully developed female lac insect measures about 2·8 mm. and the female *Eupelmus tachardiæ* larva and pupa when found in the lac females always lie in a curved

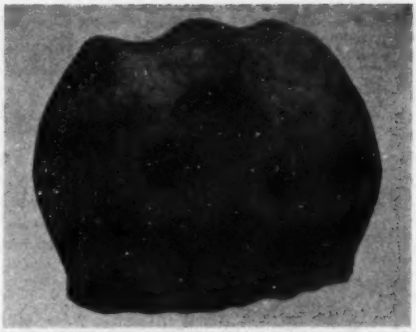

Fig. 4.

Microphotograph of female pupa of *E. tachardiæ* in a nearly fully-developed female lac cell showing a hole by biting which female *E. tachardiæ* emerged. × 18

Fig. 5.

Microphotograph of female pupa of *E. tachardiæ* female emerged from the cell shown in Fig. 4. × 13

Fig. 3.

Microphotograph of female pupa of *E. tachardiæ* in a nearly fully-grown female lac cell partly opened. × 20

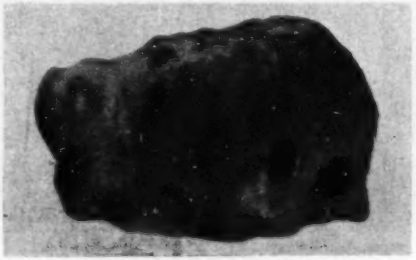

Fig. 6.

Microphotograph of female lac cell showing hole made by *Eryncyrtus dewitzi*. × 13

Fig. 7.
Microphotograph of female lac cell showing a hole made by *Parechthrodryniut clavicornis*. × 13

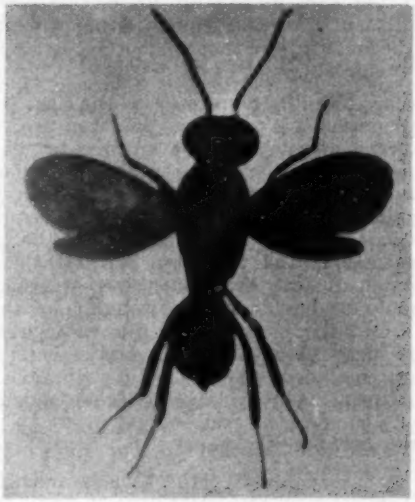

Fig. 8.
Microphotograph of female of *E. tachardiæ* male. × 20

position as will be seen from Fig. 3. It would be evident therefore that Mahdihassan has unnecessarily taken the trouble to explain the shape and size of the lac insects.

Again Mahdihassan has indirectly tried to put into our mouth that the lac insect parasitised by *Eupelmus tachardiæ* survives and that three pupæ of *E. tachardiæ* were found in a dead lac insect, although we have never said so. But as stated previously we do say that when *Eupelmus tachardiæ* is a hyperparasite on chalcids developing in nearly adult female lac insects, it is not uncommon to find along with one male *Eupelmus tachardiæ* larva or pupa upto four or more than four larvæ or pupæ of the chalcid on which it is a hyperparasite each inhabiting its own compartment inside the same dead lac female.

Eupelmus tachardiæ in every stage of its life has very distinctive characters and we regret that we cannot accept Mahdihassan's suggestion that we have mistaken *Eupelmus tachardiæ* and *Aplatomorpha calandræ* for the same insect. The illustrations given here will convince any critic that we are talking of *E. tachardiæ* and not of *A. calandræ*.

In Mahdihassan's opinion, we have shown gross ingnorance of our knowledge on the identification of our chalcids by saying that we sent our chalcid *E. tachardiæ* to experts 'for identification and not for confirmation' of our own identification. The Entomological Department of this Institute is meant to work on lac and the insects associated with lac and we therefore feel it our duty to take proper precautions by approaching the experts for identification even for insects which are most easily identified and prominent and fail to understand as to how in acknowledging the help thus rendered we could be held to be ignorant. As to his question who identified our pupæ, we have only to repeat that the pupæ developed from the eggs laid by the *Eupelmus tachardiæ* female under observation in the laboratory on *M. greeni* larva bred likewise, and developed into *E. tachardiæ*. We have not talked either on surmise or on a single doubtful observation but on a series of solid facts observed both in the field and the laboratory. To convince Mahdihassan of his mistakes besides offering our data we suggested to him to breed *E. tachardiæ* on both the insects in the laboratory but he refuses to do so on the plea that induced parasitism might result. We are unable to follow how induced parasitism comes in, if he cages healthy *Eublemma amabilis* larvæ and *M. greeni* in different stages of larval growth parasitic on *E. amabilis* larvæ and sees whether *E. tachardiæ* attacks the healthy *E. amabilis* larva or the *M. greeni* larva

feeding on *E. amabilis* larva either with or without cocoon.

In this controversy we had tried to avoid mention of exceptional cases but since Mahdihassan refuses to be convinced and stand corrected and since due to work of more practical importance in hand it may not be possible for us to publish a detailed paper on *E. tachardiæ* in the near future, we might state for the information of the readers that in the last twelve years, only in four instances we have come across *E. tachardiæ* parasitising *M. greeni* larva in the field prior to spinning a cocoon. In these cases, the damaged lac, covering the *E. amabilis* larva evidently also served the purpose of *M. greeni* cocoon for the *E. tachardiæ*. Because all that the chalcid needs, besides a supply of food to its young, is a protection for its egg or eggs, and when the chalcid did not easily find a mature *M. greeni* larva in cocoon, it laid eggs on the pre-cocoon larval stage of *M. greeni*. In such cases the laboratory examination and observations go to show that the *E. tachardiæ* larva after devouring the *M. greeni* larvæ on which it developed attacks even the unparasitised *M. greeni* larvæ if they are present and in the absence of these, the larva goes on biting here and there on the remains of E. *amabilis* larva which is contaminated with the smell of its host (*M. greeni* larvæ). If Mahadihassan is quite sure of his observation then his solitary observation would probably fall under the above-mentioned category. A careful examination in such cases, however, always reveals the presence of the empty egg shells, shrivelled eggs and larval moults of *M. greeni* on the remains of *E. amabilis* larva or its surroundings.

P. S. Negi.
S. N. Gupta.

Indian Lac Research Institute,
Namkum,
December 20, 1937.

The Distribution of the Mean Fisher's t^2.

Mr. K. Raghavan Nair has recently made some comments[1] on my paper entitled "The distribution of the mean of Fisher's t^2 for samples from a normal population".[2]

So far as I am aware (1) the relation between the ratio of variances between and within samples and the average of the t^2's and (2) the nature of the distribution of the mean of a number of independent t^2's based on a common variance have not been given anywhere else.

The illustration given on page 530 was not intended to be new, but merely to illustrate the use of the previous formula given in the paper.

Mr. Nair has not caught my point for the case where the groups differ. Here my point is that the usual method of working out the sum of squares for calculation of significances breaks down owing to non-orthogonality, and that t^{-2} method is helpful in such cases.

The objections raised in the last two paragraphs are not tenable, because the experimenter who will be anxious to get as much information from the data as is possible will surely take into consideration the significance of the differences between the various possible combinations of the 'p' treatments, and it is but natural that a combined test for all these treatments should be based on some function of these t^2's. In the present case, I have suggested the mean of all these t^2's as the basis for the combined test. The distribution of this mean, as it involves only $(p-1)$ independent comparisons can be taken to be the one shown in the paper.

P. V. Krishnaier.

Imperial Agricultural Research Institute, New Delhi,
January 29, 1938.

[1] *Curr. Sci.*, 1937, **6**, 59–63.
[2] *Ibid.*, 1935, **4**, 37–39.

[1] *Curr. Sci.*, 1937, **6**, 290.
[2] *Proc. Ind. Acad. Sci.*, (A), 1937, **5**, 528.

REVIEWS.

Human Affairs. Planned and Edited by R. B. Cattell, J. Cohen and R. M. W. Travers. (Macmillan & Co., London), 1937. Pp. xi + 360. Price 10*s.* 6*d.* net.

The editors have succeeded in enlisting the co-operation of fourteen eminent scientists for an authoritative exposition of the theme of organising human life and for making a new human race. This is optimism *in excelsis*. However, the object of the editors in projecting this volume is to create a body of public opinion in favour of referring all the political, social and economic problems to the sciences which deal with humanity. The editors contemplate launching a monthly Journal called *Human Affairs* "to bring topical problems into fruitful contact with recent advances in the social and biological sciences" and the book is intended to pave the way for this periodical if the public should accord to the forerunner the necessary support, which in a way will be a test of the need for such a Journal. The book itself is undoubtedly a great contribution and the public response, we are confident, will be quick and adequate. We hope that it will be sufficiently encouraging to enable the editors to start the projected Journal.

The articles are intended to point the way for the amelioration of the modern social life rendered dubious and difficult by the intense and wide-spread application of the results of scientific discoveries to industries. The economic and social conditions of different nations have introduced in politics the strange doctrine that the best means of establishing universal peace is to increase expenditure on armaments. The scientists look amazed as the fruits of their labour are prostituted by politicians for the destruction of people, and it is only natural for the common people to attribute the evils of their poor condition to the progress of science. Against the erroneous view usually adopted by the unintelligent public, the book furnishes a thesis intended to show that social sciences are capable of solving the bulk of human miseries and of promoting the betterment of the existing class relations. "The roots of unemployment, ill-health, mental disorder, warfare and all the other major and minor troubles of our time, can only be unearthed by scientific research and remedied by such research." This is the possibility which the biological sciences hold out for the solution of evils which must yield to the patient investigation by the psychologist, the economists and the biologist.

All the articles in the book are written by authors, who are experts in their respective fields of study and while each can be read independently, there is however an underlying theme of what science can do for the mitigation of the social chaos and for the safe and satisfactory evolution of the higher destiny of mankind. All the authors are agreed that the cultivation of social and biological sciences and the application of the results of such study to the theory and practice of administration might tend to remove the present tangle in which the social structure is involved. It is not the form of government that matters for promoting human worth and happiness as the spirit and outlook underlying its measures. This spirit is the latest doctrine "Scientific Humanism" of which the book purports to be the official expositor.

The book is as distinguished by breadth of vision as it is illuminated by searching enquiries. Every university student, whether pursuing scientific or humanistic branch of study ought to peruse this book, if he wishes to become in the fulness of time an enlightened and wise citizen. Every leader of public life would profit by a careful perusal of this book, and every intelligent man who takes an interest in the progress of society and public affairs, will keenly watch the appearance of the promised Journal. We congratulate the editors on publishing this delightful book whose value is bound to increase as the problems of social and economic life unfold themselves.

Excellent photographs of all the authors and those of the editors are included, with short biographical sketches. They lend additional charm.

Evolution and Its Modern Critics. By A. Morley Davies. (Thomas Murby & Co., Fleet Lane, London, E.C. 4), 1937. Pp. xii + 277. Price 7*s.* 6*d.* net.

Is there a half-way house between the theory of evolution and the doctrine of special creation? The acceptance of either

one or the other must presumably be based on the evidence in its support. Biologists relay on the evidence afforded by comparative anatomy, palæontology and embryology together with the facts and phenomena of distribution of organisms in support of the theory of evolution, and its opponents point out unbridged gaps in our knowledge as proofs against the theory. It is not the province of biology to investigate how life came into existence, but its problem is to account how the differences have arisen among plants and animals and to seek for genetic relationship among them. The theory of evolution is implicit in the establishment of such affinities. The process taking place in Nature in the production of species of different animals and plants is in a way successfully imitated by breeders and fanciers and by scientists in their laboratories. The opposition to the theory of evolution arose from the mistaken fact that its advocates wanted to disprove the existence of Deity, and rob Him of His creative powers. Perhaps, the scientists know more about the Deity and His powers than His official agents. Controversies of scientific theories are bound to arise when they conflict with cherished faiths, and the churches tolerate only such scientific knowledge as will not affect their authority to dictate and direct fundamental opinions.

Although the book is intended to be a reply to Douglas Dewar's "Difficulties of the Evolution Theory" and similar difficulties expressed by other writers, its purpose is to provide the general reader with a clear and authentic exposition of the mass of evidence recently collected by investigators in different fields of enquiry, in support of the theory of evolution. It may not be possible for obvious reasons to base the theory on the account of Genesis as laid down in the Bible, and difficulties arise when attempts are made to harmonise the scientific theory with the teachings of scriptures. But the difficulties of scientists in the way of accepting the evolutionary theory are of a different order and they can be answered by verifiable facts. There must necessarily be gaps in our knowledge, but such gaps need not hinder the development of a connected story, but cannot be used as factors nullifying the story itself. We believe that the principle of evolution is a fact which this excellent book has treated in its historical and scientific aspects in a way which all may read with profit and few will remain unconvinced in the end of the solid foundations of this great scientific generalisation.

We welcome this book which is written without passion and prejudice but with the sole idea of presenting facts clearly and convincingly. To the lay readers the Glossary will be of great assistance and to the students of science, the list of Bibliography will offer a wide field for selective study.

Ecological Animal Geography—An authorised rewritten edition based on *Tiergeographie auf Oekologischer Grundlage*, by Richard Hesse. Prepared by W. C. Allee and Karl P. Schmidt. (John Wiley & Sons, Inc., New York; Chapmann & Hall, Ltd., London), 1937. Pp. xiv+597. Price 30*s.* net.

Since the publication of Hesse's *Tiergeographie* in 1924, several books on animal distribution have been published. These books and Lydekker's *Wild Life of the World* deal with the ecological factors and Hesse's work laid emphasis on the close relation between ecology and zoogeography. "When ecology is approached from its geographic aspects, many of the details of ecological relationships cannot be considered. Notwithstanding the fundamental importance of certain of these details, there are distinct advantages to be gained from looking at ecological problems from a world-wide basis; it is easier to gain a general perspective thus and to obtain sufficient detachment for making and appreciating generalisations. The pedagogical advantages of the approach of ecological problems and phenomena from the standpoint of world distribution have grown increasingly evident to teaching ecologists." In all universities in which this young branch of Zoology forms part of the regular curriculam of studies, teachers must have found the value and importance of treating the subject from the larger standpoint and especially when the exposition of the problems of animal distribution is treated as part of the subject-matter of ecology after an exhaustive course of the more systematic study of formal zoology, the philosophical implications of the conditions and modes of the existence of life acquire a new significance.

This book is not a literal translation of

Hesse's work which, in the course of preparation for English readers, has undergone several alterations. The editors have added information from their own study and researches, and have revised several sections where they have first-hand experience. These changes refer to the omission of Lamarckian interpretation of animal zoogeography, the greater emphasis on the theory of marked climatic variations of the world's history and the stability of the present ocean basins and wider exposition of Matthew's theory of the holarctic origin of vertebrate life which was not mentioned in the original text.

The older works on zoogeography did not emphasise the ecological aspects, but were based on historical distribution of species in which the homologies received special attention.

Structural adaptations to environment at one time formed the major and more important part of the study of animal distribution and the influence of the condition of the environment, such as the value of temperature, relative humidity, intensity of sunlight, the nature of vegetation, the physical and chemical character of the soil, the presence or absence of other animal groups, has now become the subject of active study and investigation. These external conditions in conjunction with geographic differentiations have exercised considerable influence on animal organisation, and the data accumulated by faunal zoogeography furnish the basis for the recognition of homologies and analogies in respect of animal distribution.

The book is divided into four main divisions. The first part deals with the ecological foundations of zoogeography and the succeeding sections are devoted to the study of the distribution of marine, freshwater and land animals respectively. Equal prominence is given to every community of animals. Each chapter gives a full exposition of the problems concerned and the book as a whole is a scholarly treatment of the subject which is a young but promising offshoot of biology. A selected set of bibliography is appened at the end of each chapter.

Students electing zoology for their honours degree in Indian universities have to study the closely related topics including animal ecology and distribution, but they may perhaps find the book far too detailed and elaborate for purposes of supplementing either their systematic study of faunistic groups or the philosophical theories and principles. As a work of reference, it is at once superb and indispensable. In fact, no comprehensive concept of the fundamental aspects of zoological science can be gained without an adequate study of the problems of animal distribution and few books in the English language present these ecological problems in a more stimulating manner than Alle and Schmidt's preparation of Hesse's great work.

The World of Atoms. By Arthur Haas, Ph.D. Translated by George B. Welch. (Chapman & Hall, Ltd., London), 1937. Pp. xiv + 183. Price 10*s.* 6*d.* net.

The first edition of the book under review was published in 1928. In this, the second edition, the author has brought the book up-to-date by the addition of new matter. As a popular and accurate introduction to the present state of our knowledge of the nature of matter and radiation the book may be strongly recommended to all interested in recent advances made in physical science. The new discoveries such as the Nutron, the Positron, Atomic Disintegration and Artificial Radioactivity all are treated in non-technical language, that is, both clear and accurate. Often the defect of popular books on scientific subjects is that accuracy is sacrificed in the attempt to make the subject intelligible to the lay reader. We are glad to say that in the present case this defect is entirely absent. We wish particularly to stress the subject-matter of the 11th and 12th lectures as a concise and comprehensive summary of the most recent work in Atomic Physics. We have no hesitation in recommending the book to the general reader interested in modern scientific advance. To the specialist also it would be refreshing to read this masterly summary of recent work. One can gather from the Books of Professor Haas that he possesses in an abundant measure the rare faculty of combining brevity, clarity and precision in his writings and this book is no exception to this rule. We congratulate the translators on the excellent manner in which they have discharged their part of the work.

B. V.

A Text-Book of Physics. By Dr. D. B. Deodhar. (The Indian Press, Ltd., Allahabad), 1937. Pp. iv + 672. Price Rs. 6.

The rapid growth of Physics since the beginning of the century has created a stiff problem in the teaching of Physics. Not all those who study Physics become professional physicists, but most of them take up other avocations in life where their knowledge of Physics is not directly used. Keeping this in mind, are we to treat Physics as a means of mental discipline and confine ourselves to the none too recent portions as serving the purpose quite as well as modern developments? On the other hand, the recent discoveries in Physics are of so fundamental a nature that they have influenced other branches of knowledge and bid fair to alter our fundamental views of life. Under these circumstances should not every man claiming to have culture know something of these developments? Then there is the limited time at the disposal of the teacher; he can give a fairly sound training in a restricted portion, or a superficial knowledge of a wider field. On which of these alternatives should the choice fall in framing a syllabus? It seems to us that no *via media* can be found and so it would be most economical in the long run if Physics is offered in two different courses, a more intensive and extensive course for those who may, in future, hope to use their knowledge of Physics, and a more general and simple treatment for those to whom Physics is but one among many interests. This division would roughly correspond to the present Honours and Pass courses, but to us it appears that a bifurcation at the Intermediate stage itself will be productive of better results and less wastage of effort. If this is done, the pass candidate can be given a fair glimpse of up-to-date Physics without much strain from mathematical severity, while the Honours man can be taken more gradually through his more arduous course. In spite of the desirability of both depth and expanse, it would be futile with the present vast field of knowledge to compromise and try to serve both ends.

The book under review is one of the recent text-books which cannot withstand the lure of modern developments but which yet do not break with syllabuses and examinations and must needs attempt both depth and extensiveness. They may succeed admirably by ruthless compression, but in actual teaching, the time available will by no means be adequate to do justice to these books. Thus in the present book which is said to be intended for Intermediate students, we find the wave theory of light, elasticity and surface tension, some thermodynamics and kinetic theory including van der Waals' equation, the quantum theory slightly touched upon, and then we have the neutron, positron and deuterium, X-rays, positive rays and wireless. Probably as a consequence there is not a single worked example in mechanics, heat or light or electricity and magnetism. With courses of study as at present constituted, it is quite impossible to treat the subject at this length in any Intermediate class. On the other hand, the portions that can be managed will be found to have too compressed a treatment in the present book which plunges into protons and electrons on the very second page. If there is any student rich enough to afford a private tutor to give him a fair glimpse of Physics with no necessity to sit for an examination, this is the very book for him. Or if as we have previously hinted, the courses of study are divided into Pass and Honours standards at the Intermediate stage, this book, with some omissions and additions, will take the student to the end of the Pass Degree Examination. Most of the every-day technical applications of Physics have been well dealt with and the illustrations are numerous and excellent. We have reluctantly to add that the book shows very often a tendency towards loose and incorrect statements, particularly in the portion on Mechanics. Here are a few examples:—

P. 4. "When the sun is in the zenith that time is known as solar noon" *for* "when the sun is on the meridian".

P. 17. "Law I—Every body preserves its state of rest or of motion in a straight line" *for* "state of uniform motion in a straight line".

P. 31. "The total momentum before impact must be the same as the total momentum after impact by the principle of the conservation of energy", whereas there is actually a loss of energy at impact unless $e = 1$.

P. 33. The coefficient of friction "is the ratio of the normal force to the corresponding frictional force". The usual definition is by means of the relation $F = \mu R$. To say that "the weight of the sliding

piece together with its load will be always less than the weight of the scale pan together with the load in it" is wrong, for this means that the angle of friction is always greater than 45°.

P. 82. "The mass of a sphere acts at its centre." (?)

P. 84. "The level difference is determined by the work done in moving a unit mass from one level to another." (?)

P. 84. "$G = 6{\cdot}65 \times 10^{-8}$ dynes/cm$_2$." (?)

P. 125. "The pressure at $C = \pi r^2 \times h_1 \times d_1$" *for* "the pressure $= g \times h_1 \times d_1$."

P. 161. "Lavoisier and Laplace improved upon Boyle's method" of finding the latent heat of ice. (?)

P. 293. "n for air $= 1{\cdot}000000278$".

P. 298. "$i_1 > r_1$ and $i_2 > r_2$ and therefore $i_1 - i_2 > r_1 - r_2$."

P. 322. "$1 + D/f$ is nearly equal to D/f". Not necessarily unless f is very small.

P. 324. "The focal length of the eye-piece should always be greater than that of the objective" in a compound microscope. (?)

P. 496. The net gain of energy of the electrometer needle and quadrants is equated to the work done in twisting the suspension, and this is wrong.

Many proper names are habitually misspelt, *e.g.*, Réumer for Réaumur, van der Waal for van der Waals, Calladon for Colladon, Kirchoff for Kirchhoff, Brodhum for Brodhun, Fraunhoffer for Fraunhofer, Focault for Foucault, Milikan for Millikan, etc. It would be idle to fill this review with many other minor errors we have noted. Our object in noting the above is only to eradicate such blemishes from a good book. We recommend all B.Sc. students to work through this book, with occasional supplementing where needed. University authorities should also ponder over the problem, of whose existence the publication of this book is a sign.

T. S. S.

Sound. By Arthur Taber Jones. (Chapman & Hall, Ltd., London), 1937. Pp. xii + 450. Price 20*s.* net.

It is seldom that in an introductory text-book of science meant for college students, one finds a good deal of historical account as given in this book on sound. Yet the author's one definite aim in doing this is "to aid students in developing the ability to reason correctly and to stimulate an enjoyment of intellectual activity." The fulfilment of this object would depend upon the student's sustained reading and patience to keep up the interest to the last. In practice, it would be futile to expect a college student who has a number of subjects for study, to digest the main principles of the subject while keeping to the historical development of each and every aspect. In this sense, the book is not likely to serve as a text-book, but as a book for general reading. When used thus, the author's aim to stimulate the faculties of independent thought and reasoning will be more than fulfilled.

The book describes a number of different topics which are not usually found in ordinary text-books on sound. The comprehensive character of the work can be judged, if we mention some of the important subjects and their applications coming within the scope of the book. From simple phenomena of sounds, such as, those resulting from the impact of two balls or the falling of liquid drops over a liquid surface, the author passes on to consider intricate subjects like the musical scale, the temperament or the mechanism and the theories of hearing. One would have expected in this book a good deal of mathematical treatment, but to the relief of the general reader, this has been scrupulously avoided to give place to mere chronicling of experimental conclusions and phenomena. Even the subjects like vibratory motion and interference have been left free from any sort of mathematical encumbrances. Throughout the whole length of 440 pages of subject-matter, there are hardly found about a dozen mathematical expressions in the real sense. Among the most important chapters are those on transmission of sound, free and forced vibrations, hearing, musical instruments, speech and song and technical applications. References among these, to many curious phenomena and interesting problems, such as, the spectacular but complex forms of Lissajous figures, the vortices obtained behind a moving body and in flue pipes and many others, will not only stir the curiosity of a general reader, but impel many a research enthusiast to further investigations. In giving the explanations of the many phenomena, the author has put forward the views of different investigators without in any way standing in judgment on them. This has been well left to the students of the subject to think and ponder over.

It would, however, be noticed that only a passing reference has been made to the

growing subject of ultra-sonics, the recent investigations on which should have been, by preference, included in detail. The application of modern radio valves and electrical circuits to many problems on sound, such as, the sound film and aids to hearing, has been dealt with concisely. In general, we should have expected more space in such a book to technical applications of sound. But this can be excused in a book which is meant by the author to be only introductory.

In spite of the few shortcomings pointed out above, the book contains a rich store of knowledge and deserves to be studied by every student of Physics. On account of the descriptive nature of the treatment accompanied by illustrations and freedom from technicalities, it may as well be recommended to a general reader and would be an acquisition to any library. N. R. T.

A Text-Book of Light. By G. R. Noakes. (Macmillan & Co., London), 1937. Pp. 335. Price 6*s*.

This is a well-written book suitable for pass standard students. The treatment is clear, and the different topics receive the attention necessary for the standard. Every chapter ends with a good selection of questions and examples. The diagrams and the general get-up are good.

A. Venkat Rao Telang.

The Fine Structure of Matter. Volume II, Part I.—X-Rays and Structure of Matter. By C. H. Douglas Clark. (Chapman & Hall, Ltd.), 1937. Pp. lxii + 216. Price 15/- net.

The author of this book has presented in a concise form a readable non-mathematical account of the structures of crystals and other substances as determined by X-rays. The first chapter of the book describes the elementary principles of crystallography and the classification of crystals into point groups and space groups. The next four chapters deal with the structure of inorganic crystals which have been classified according to the number of atoms per molecule of the substance. Typical examples illustrated with excellent diagrams of the structure of substances belonging to the same characteristic point group have been discussed and the results of analysis, namely, the dimensions of the unit cell and the space group, have been tabulated in a manner which enables easy reference.

Chapter VI is devoted to structure of inorganic crystals. This has been divided into several parts describing the results on acyclic and cyclic structures the latter being classified into single benzene ring compounds, two or more benzene ring compounds, heterocyclic compounds, etc. Later chapters cover a wide variety of topics: the study of colloidal systems, liquid crystals and fibre structure; structure of metallic solutions and of inter-metallic compounds; mechanical distortion of crystal structure; other applications of X-rays prominent amongst which are the qualitative and quantitative analyses and the determination of the particle size by means of X-rays; the principles of the determination of molecular constitution and the factors which affect crystal structure.

The book is essentially a reference book and should prove to be of great value to those engaged in work on crystal structure. Fairly exhaustive references to earlier work are given at the end of each chapter. This book along with Ewald and Hermann's *Strukturbericht* which is constantly referred to by the author is recommended to a student entering this field of research who will find preliminary data on any of the varied applications of X-rays without much inconvenience. M. P.

A Text-Book of the Differential Calculus. By S. Mitra and G. K. Dutt. (W. Heffer and Sons, Ltd., Cambridge), 1937. Pp. xiv + 302. Price 10*s*. net.

The authors have prepared this book on the assumption that "the want of a suitable book on the Infinitesimal Calculus in the English language has been felt keenly by almost all teachers in the Universities of India". The book has been probably prepared to meet the needs of the Honours students of some of the Indian Universities, but it does not suffice for the Honours standard of some other Indian Universities. The authors have taken great pains to explain in a remarkably lucid language many subtle problems and reasonings, and the students and many teachers will find much in the book that is profitable. There are, however, a few places wherein there is scope for using more rigorous language and proofs. The proof of Abel's Theorem, on page 130, cannot be accepted.

The treatment of several topics is too

brief, in particular the chapters on geometrical applications, but this may be on account of some particular standard which the authors have in view. There is no adequate discussion of singular points of curves, though the terms node and cusp are casually mentioned and the conditions for a node stated without proof.

The authors are at liberty to pay their homage to the Calcutta University, but they should do so in a befitting manner. To attribute very common problems which could be set by any examiner in any college, as questions set by the Calcutta University under specified dates is not good taste. When text-book writers refer to Math. Tripos problems and the like, these will generally be problems which were set or published *for the first time* in those examinations.

The printing and get-up of the book is excellent, though an Index ought to have been added. The Table of Contents preceding the Preface is an uncommon feature.

C. N. S.

Une Conception nouvelle de la Supraconductibilité. Par F. London. (Actualités Scientifiques et Industrielles No. 458.) (Hermann et Cie, Paris), 1937. Pp. 81. Price 20 *fr.*

Prof. London's theory of supraconductivity starts on a new path altogether different from the usual conception of supraconductivity as the limiting case of ordinary conductivity and it succeeds in explaining a number of facts. It has evoked considerable interest, although it cannot yet be said to have disposed of rival theories and come to be the accepted theory. The publishers deserve our thanks for making this authoritative exposition available to a large number of readers. It appears to us that the volume would have considerably gained in utility if a short summary of the experimental facts had been given before plunging into the theory.

T. S. S.

La Cinetique Operatorielle: Chapitre premier du Traité de Mécanique ondulatoire des Systèmes. Par Jean Louis Destouches. (Actualités Scientifiques et Industrielles No. 409.) (Hermann et Cie, Paris). Pp. 70. Price 18 *fr.*

In this part of a projected treatise on the wave-mechanics of systems, the author has explained how dynamical variables have been replaced by operators in the new transformation theory of quantum mechanics and has given a succinct account of the calculus of operators. In interpreting the significance of quantum mechanics he takes the view of Bohr that corpuscles are only localised at the moment of observation and are otherwise distributed in some kind of virtual state, thus upholding indeterminism. The book is a keen and interesting analysis of quantum mechanics and we await with interest the appearance of the subsequent parts.

T. S. S.

A Text-Book of Inorganic Chemistry. By J. R. Partington, Fifth edition. (Messrs. Macmillan & Co., Ltd., London), 1937. Pp. viii + 1062. Price 15/-.

The last edition of the well-known Partington's *Inorganic Chemistry* appeared in 1934. In the present fifth edition, some important advances in the subject have been incorporated, the scope and other characteristic features of the book remaining however mainly unchanged. The theoretical parts and the sections on Physical Chemistry have been further enriched with additional matter on the theory of indicators, thermochemistry, structure of silicates, the heavier isotopes of hydrogen, and the recent researches on nuclear transformations. Other chapters where essential revisions have been made and information based on recent technical advances included, are those on the halogens, the inactive elements, and nitrogen and its compounds.

The book will no doubt continue to meet with the approbation of the active teachers in the line, who endeavour to touch upon the line portions of the subject, while it maintains, at the same time, with improvements the didactic features such as chapter summaries, questions and exercises. The new edition is an asset both to the teacher and to the student.

An Introduction to Comparative Biochemistry. By Ernest Baldwin, with a Foreword by Sir Frederik Gowland Hopkins. (Cambridge University Press, Cambridge), 1937. Pp. xviii + 112. Price 5*s.*

The contribution which Biochemistry has made to the study of the evolutionary history of life, is at once significant and

fascinating; but curiously enough, the branch of biochemistry devoted to such a study—comparative Biochemistry, has scarcely received the attention its importance entitles it to. Dr. Baldwin, in a monograph of about a hundred pages, has not merely succeeded in defining the scope, aims and objects of this interesting branch of science and dealt with its different aspects in a masterly fashion but, what is more important, has succeeded in stimulating interest in this subject. The difficulties involved in presenting a subject which, to use Dr. Baldwin's words 'takes root in many domains of scientific knowledge and can only be approached from a very wide view-point' and 'whose data lie scattered throughout almost the entire field of biological literature,' cannot be exaggerated. Dr. Baldwin has earned the gratitude of a large circle of readers for the able presentation of a subject of great interest and wide appeal.

There are *a priori* reasons for believing that life began in the sea. From this cradle, numerous forms migrated to fresh water and thence to dry land. The colonisation of fresh water by a selection of the marine animals must have been an exceedingly difficult performance; and the colonisation of the land by some fresh-water animals even more so, necessitating far-reaching adaptational changes. The change from the sea to fresh water is a change from a medium of comparative thermal stability, not subject to violent currents and containing osmotically active salts to one liable to temperature fluctuations, changing currents such as are found in rivers, and containing very little salts. The physico-chemical consequences of such a change and the morphological and functional changes that became necessary, are briefly described and aptly illustrated from the life histories of representatives of marine and freshwater organisms. The change from the fresh water to terrestrial environment involved numerous difficulties for the organisms with serious biochemical consequences; thus, being cut off from an aquatic environment they had to face the danger of water shortage; the respiratory apparatus had to undergo modification to permit of air-breathing and suitable mechanisms had to be developed for the excretion of waste products. All these topics have been thoroughly discussed. In support of the theory of evolution a few chemical evidences are furnished. Thus while dealing with the theory of recaptulation according to which the developing embryo is 'a kind of museum of evolution', attention has been drawn to the work of Needham on the chick embryo which, in the early stages, excretes ammonia like aquatic organisms, then urea like the amphibians and later uric acid like the aves or in other words the chick embryo recapitulates in a chemical sense. The last chapter dealing with the respiratory catalysts, although of profound interest, does not appear to fit into the general theme of the book.

The treatment of the subject is profound and the interest of the reader is sustained from the beginning to the end. The book is undoubtedly a valuable addition to the literature dealing with "the physico-chemical approach to evolutionary problems".

Earth-Lore: Geology without Jargon. By S. J. Shand. Second Edition. (Thomas Murby & Co., London), 1937. Pp. 144. Price 3/6 net.

We are glad to welcome a second edition of this little book by Prof. Shand. Similar in general appearance to the first edition published in 1933, the book has now been revised and enlarged. As many as 12 new plates have been added, to illustrate geological phenomena mentioned in the text. A new chapter on "Atlantis and other Lost Continents" has been included, in which the author discusses the validity of the legendary beliefs in the past existence of kingdoms and provinces that have now been lost beneath the sea—like for instance, the great Atlantis of Plato—and points out that, to the modern geologist, the evidence put forward in support of their existence appears to be of the flimsiest and most unconvincing kind. According to Prof. Shand "there is no valid reason to believe that any 'lost continent,' has ever existed either in the Atlantic or in the Pacific, since man appeared on the earth."

The author has done a great service to the cause of geology by writing this interesting and readable book in which he takes a general survey of the entire field of modern geology, and presents the main conclusions in a vivid and fascinating manner.

L. RAMA RAO.

ARCHÆOLOGICAL NOTES.

A New Archaelogical Discovery.

AN unexplored site containing more than fifty tombs of a very remarkable and unique type, so far India is concerned, has been discovered by the writer in the Las Bella State, Baluchistan, and a few tombs of similar type have also been discovered in the Karachi District. The place is situated between the Gandh-ko Mountain and the village Bhawani, about 27 miles away from Karachi. The tombs are lying in a waste land surrounded by thick bushes of cactus.

These tombs are not very big in dimension but of unusual type as this kind of tombs are not found anywhere in India. They are formed in steps or tiers 5 to 9 in number. These step-like tombs are made by slabs of carved stone placed horizontally on the ground and around them other beautifully carved slabs are placed vertically forming a box-like rectangular chamber, upon which five or six similar chambers of smaller dimensions, diminishing towards the top are made to complete the tombs. These chambers are generally closed on all sides but in some tombs the lowest chambers are open on all sides by forming arches in the slabs. On the front side of some of the tombs one or two short stumpy pillarette with vase-like projections are placed on the top. The length of each tomb is about 6 to 7 feet, and the height is about 7 to 9 feet. The width is about 3 feet at the base of the tomb and about 6 inches at the top.

Geometrical designs are carved in the slabs showing neat and fine figures in relief. The important designs common to most of the tombs are lotus and half-lotus which are the characteristic designs of the Hindus.

Locally, these tombs are called by old people, "Rum-Ka-Kabbar," but they are unable to say about their history. From the name "Rum" or Rome (Roman), from the existence of the Roman vase-like projections, from the unusual type of tombs and also from the fact that this site lies on the ancient route of Alexander the Great, it may appear that there might be some Greeco-Roman connection but these tombs are not in any way connected with them. These are purely Muhammadan tombs.

From the analysis of the workmanship and designs of various remains of ancient tombs in Sind, I have come to the conclusion that these tombs were probably built during the period of Samma Dynasty of Sind dating back to, not earlier than fifteenth century A.D. and not later than seventeenth century A.D.

We find a gradual development of this kind of workmanship in Sind from the earliest time upto 1450 A.D. and a gradual decline from 1550 A.D.

The type of workmanship and design of these tombs are strikingly similar to that of the tomb of Jam Nizamuddin, the fourteenth prince of the Samma Dynasty at Tatta, though the construction of the tombs is quite different which indicates that these tombs do not belong to the Samma people.

During this period, there lived in some part of Sind and Baluchistan three powerful Muhammadan tribes other than Samma people. They were Karmatis, Jokias and Numrias. It is very probable that these tombs belonged to the Numrias. The word "Rum" in "Rum-Ka-Kabbar" is very significant. The word "Num" has probably changed to "Rum" in course of time.

Though these are Muhammadan tombs, we find a marked Hindu influence on the workmanship and designs. This is probably due to the Hindu origin of the Numria tribe. The Numrias as well as Jokias and also Sammas were originally Rajput Hindus who were converted to Muhammadanism in later dates.

The idea of the step-like construction of these tombs was probably carried by Karmatis who came from Persia and who inter-married with the Numrias while they settled on the valley of Pabb Hills.

C. R. Roy.

Victoria Museum,
Karachi,
January 26, 1938.

Bhûtamaṅgalam of Buddhadatta.

IN the Pâli work *Vinayaviniccaya* composed in the fifth century A.D. by the eminent South Indian Buddhist scholar, Buddhadatta, it is stated that this work was written by him for the benefit of the Buddhist Bikkhus in the monastery built

by Veṇhudāsa at a place called Bhūtamaṅgalam.

A translation of the relevant portions pertaining to this place is given below:

"In the tranquil village of Bhūtamaṅgalam where inhabit different classes of peple, which was the naval of the famous Cōḷa country, filled with groves of plantains, sal-wood, palmyra and cocoanuts, as well as cool tanks adorned with lotuses and *utpala* flowers, and the whole soil anointed by the flowing waters of the Cauvery, and a Maṅgala endowed with all the elements of prosperity, in the beautiful and pleasant monastery surrounded by well-built outer walls, and moat belonging to Veṇhudāsa, · · · · · ·by me who lived (in Bhūtamaṅgalam) in a mansion· · · · · ·was composed · · · ·this work on the principles of Vinaya · · · · for the good of Bikkhus who desire to learn the Vinaya text in a short time without difficulty."

Attempts have been made in recent times by a few scholars in locating this historical Bhūtamaṅgalam in the Tanjore District. The editor of *Vinayaviniccaya*, Rev. A. P. Buddhadatta, remarks in his introduction: "At present, there are several places in that country (Tanjore) having their names ending in Maṅgal. But I am still unable to identify this Bhūtamaṅgal with one of these places". Later on, Mr. P. T. Srinivasa Iyengar, at the suggestion of Mr. K. R. Subramaniam, maintained that Bhūtamaṅgalam is the same as Būdalur in the Tanjore District.[1] And this identification has been questioned by Professor K. A. Nilakanta Sastri.[2]

The monastery in which Buddhadatta composed the *Vinayaviniccaya* was according to the description located in the heart of the Cōḷa country 'sanctified by the river Cauvery'. It is therefore necessary to look for Bhūtamaṅgalam in the Mannārguḍi Taluq which is centrally situated[3] in the Tanjore District.

In the inscriptions[4] of the Cōḷa king Rājarāja (985–1013), there are references to Bhūtamaṅgalam adjoining Veṇṇi Kuṟṟam whose chief Nagara was Veṇṇi now identified with Koilveṇṇi about 20 miles to the east of Tanjore. According to these inscriptions Bhūtamaṅgalam comprised of a number of small villages, such as, Miduvēli, Nenmēli, Tiruvīramiśvaram, etc., which can all be located in the Mannārguḍi Taluq of the Tanjore District. It is therefore quite apparent that the village of Bhūtamaṅgalam must be situated not far away from Koilveṇṇi and Tiruvīramiśvaram, and must have occupied an extensive area originally. And it is also clear that the Bhūtamaṅgalam of the Cōḷa inscriptions must be the same as the one mentioned in the *Vinayaviniccaya*.

So with a view to locating this place, I went to Mannārguḍi on the 29th December 1937, and by making local enquiries discovered that there were two villages of the same name at close proximity. One of the two which I immediately proceeded to was I found mainly inhabited by the Mohammaden community and contained relics of ancient Hindu temples. The other which is about 6 miles from Mannārguḍi and situated on the banks of the river Veṇṇār, a branch of Cauvery, appeared to me to be full of archæological potentialities.

And this village is known in the locality as Paḷḷivritti Bhūtamaṅgalam; Paḷḷivritti is the name of another village which is adjacent to this Bhūtamaṅgalam. And as its name suggests, the lands within this village must have been owned by the Bhuddhist monastery at Bhūtamaṅgalam. (Paḷḷi stands for Buddhapaḷḷi.)[5]

In the course of my itinerary in these two villages I discovered three brick mounds in Paḷḷivritti and an examination of these bricks revealed that they were old. Two more sand mounds which I saw at Bhūtamaṅgalam may if excavated yield ancient Buddhist relics of great value.

Report is current in these parts that some Buddha images were removed from this place to various other villages of the Tanjore District and I came across one such image in the Jain temple at Mannārguḍi, a photograph of which is in my possession.

It seems therefore safe to conclude that the Bhūtamaṅgalam of *Vinayaviniccaya* is the same as the Paḷḷivritti Bhūtamaṅgalam of the Mannārguḍi Taluq in the Tanjore District.

C. MINAKSHI.

[1] P. T. Srinivasa Iyengar, *History of the Tamils*, page 531.

[2] *Cōḷas*, I, page 121*n*.

[3] *Tanjore District Gazatteer*, ed. by Rutherford.

[4] *SII.*, Vol. II, page 65; *Ep. Report*, No. 143 of 1911.

[5] Refer Paḷḷi in the Tamil Lexicon, Madras University.

A Cultural Museum for India.

INDIAN cultural study now leaps the barrier of boundaries to extend half over Asia, from Irak to Central Asia, China, Japan. Further India and Indonesia, so far as Bali and distant celebes. The material available in the national collections—the Aurel Stein collections from Central Asia alone are unique as documentary evidence for the spread of Buddhist art and Indian influence—if brought together under one roof, would demonstrate Indian culture in a manner possible nowhere else among the collections of the world, even in India itself.

On the grounds of public policy, the formation of a museum of Indian life and culture cannot be too strongly urged. Now that the bonds of Empire have become tenuous indeed, we hold India by a thread. But impalpable bonds, as has been shown by the visit of the British Association Delegation to the Jubilee Meeting of the Indian Science Congress Association this month, can be made stronger than any material force. To the degree in which our future policy towards India is rooted in an understanding of Indian aspirations on the part of the British people, the greater the strength of the bond that will hold this great country within the Empire. A great Indian cultural museum would certainly contribute the major part to such an understanding. It would show that whatever the differences between the two peoples may be, to India belongs a civilization older than our own, which in art and intellectual accomplishment has been in no way our inferior, while in Buddhism it has produced a creed which more nearly than any other in the world's history approaches the way of life inculcated by Christianity.

(From *Nature*, Jan. 29, 1938, pp. 178-79).

ASTRONOMICAL NOTES.

Planets during March 1938.—None of the major planets will be in favourable positions for observation during the month. Mars will be still visible in the western sky in the early part of the night; it is gradually nearing the Sun and getting fainter. Its altitude at sunset will be only about 30°. On March 5 the planet will be close to the Moon, the angular distance at conjunction being less than 3° and on March 28, it will approach Uranus to a distance of 41 minutes of arc. Jupiter is in the constellation Capricornus and will continue to be a morning star rising about two hours before the Sun. Saturn can be seen low down in the western sky just after sunset for a few days early in the month and on March 29 will be in conjunction with the Sun.

Both the inferior planets, Mercury and Venus will be visible as evening stars low down in the western sky towards the end of the month.

The New Asteroid 1937 U B.—The name "Hermes" has been given to this interesting minor planet, discovered by Reinmuch of Heidelberg in October 1937. At the time of its nearest approach to the earth on October 30, the object was just bright enough to be visible with the unaided eye and was within a million kilometres distant from the earth or less than three times the Moon's mean distance.

Comet Encke.—This periodic comet became a fairly bright object early in December 1937 and for a few days was visible with the naked eye; since then it has faded considerably in brightness. In January, it was moving slowly eastwards in the constellation Sagittarius.

γ Cassiopae.—This star which is ordinarily of magnitude 2·2 had a sudden increase of brightness a few months ago reaching magnitude 1·2. It has gradually subsided and is now nearly as bright as the stars α and β in the same constellation.

T. P. B.

CENTENARIES

By S. R. Ranganathan, M.A., L.T., F.L.A.
University Librarian, Madras

Bachet, Gaspard (1593–1638)

GASPARD BACHET, a French mathematician, was born in 1593. He was a great linguist, who had obtained proficiency in Greek, Latin, Hebrew, Italian and Spanish. He possessed also remarkable mathematical powers.

His Work

He specialised in the study of Diophantine Equations. He gave a complete general solution of indeterminate equations of the first degree in his book entitled *Problem plaisants et delectablesque se font par les nombres* (1612). This book gave a complete discussion of the famous "Boat problem". It went through a second edition in 1624 and Gauthier-Villars published a reprint of it in 1876.

In another work of his, *Elements arithmetiques*, he discussed several properties of prime numbers and of the three progressions. He also translated the works of Diophante under the title *Diophanti Alexandrini arithmeticorum lifri sex et de numeris multangulis liber unus* (1621).

His Honours

He was elected (1625) as one of the earliest members of the French Academy of Sciences.

Bachet died at Paris February 28, 1638.

Eberle, John (1787–1838)

JOHN EBERLE, an American physician, was born December 10, 1787. His father was a blacksmith. Eberle had no early educational advantages; but being constant reader he acquired sufficient knowledge to enable him to begin the study of medicine. He entered the University of Pennsylvania in 1806, where he graduated three years later, his thesis being on *Animal-life.*

His Publications

About 1818, he founded and became the editor of the *American medical recorder.* This periodical was so well received that he was elected to the German Academy of the Natural Sciences. He published *Botanical terminology* for students of botany. His *Treatise of the materia medica and therapeutics* (1823) went through several editions. He participated in the foundation of the Jefferson Medical College (1825) and became its first professor of materia medica. His *Notes of lectures on the theory and practice of medicine* was produced during this period and it went through several editions. From 1824 to 1826 he was editor of the *American medical review.* In 1832 he published his *Treatise on the disease and physical education of children.*

Eberle was a brilliant teacher. He advocated the theory of physiological drug action as opposed to "solidism" as taught by others.

He died in Laxington, February 2, 1838.

Beilstein, Fridrich Konrad (1838–1906)

F. K. BEILSTEIN, a Russian chemist, was born in St. Petersburg, February 5, 1838. He studied chemistry both under Bunsen of Heidelberg and Liebig of Munich. Having been assistant professor of chemistry at the Breslau University for seven years, he became professor of chemistry at the St. Petersburg Technological Institute in 1866 and remained as such the rest of his life.

His Contributions

He began to publish papers even in his eighteenth year. His first paper was entitled *Uber die diffusion von flumigkeiten* and was published in V. 99 of the *Annalen der chemie,* conducted by his professor, Liebig. As many as 86 papers were produced by him including 32 joint ones. His work was chiefly on organic and analytic chemistry. His work on the aromatic compounds gave a new direction to industry.

Beilstein is beet known for his *Handbuch der organischen chemie,* which is a reference work of supreme value. It is a monument of his patience and industry. The first edition appeared in 1881-83 in two volumes and the second in 1886-90 in three. These were prepared without help. With but one assistant he published the third edition in 1892–99. Thereafter the Deutche Chemische Gesellschaft took over the publication. A fourth edition was started in 1918 and is still incomplete.

Beilstein became a member of the St. Petersburg Academy of Sciences in 1886.

Beilstein died at St. Petersburg, October 19, 1906.

RESEARCH ITEMS.

Free Internal Rotation in Ethane.—Eucken and Weigert made the significant observation that at the lowest temperatures studied, ca. 140° k. the heat capacity curve of ethane gave indications of levelling off appreciably above the classical value 3 R, for the heat capacity due to rotation and translation. They concluded from this and other quantum statistical considerations that a restraining potential of about 300 cal./mol. fitted their observations best, meaning thereby that at room temperature the methyl groups in an average ethane molecule are freely rotating. Measurements of the thermal equilibrium between ethane, ethylene, and hydrogen at higher temperatures show however, that the equilibrium and thermo-chemical data are irreconcilable if the Eucken internal potential was adopted in the calculation of the entropy of ethane. G. B. Kistiakousky and F. Nazmi in *J. Chem. Phys.*, **6**, p. 18, conclude, after weighing all the evidences available, that the equilibrium measurements cannot be in error. They have therefore checked Eucken's specific heat curves and now find that there is no levelling off of the C_v curve as suggested by Eucken and Weigert, but that there is a steady decrease. This is in conformity with the calculations of Kemp and Pitzer who assume for the internal restraining potential in ethane a value of about 3100 cal. Such a high value, though its origin is ununderstandable, is in accord with Howard's analysis of the normal co-ordinate problem of ethane-line molecules and the specific heat measurements on solid and liquid ethane.

M. A. G. RAU.

* * *

Flow of Liquid Helium below the λ-Point.—P. Kapitza (*Nature*, 1938, **141**, 74) finds that the viscosity of helium below the λ-point is at least 1,500 times less than that of helium I at normal pressure. According to him helium below the λ-point enters into a special state which may be called " superfluid ". Allen and Misener (*Nature*, 1938, **141**, 75), however, find that the flow of helium II at 1° K does not follow the usual equation for laminar or turbulent motion. The velocities of flow change only slightly with the pressure head. They consider that it is possibly due to the slipping of helium II over the surface of the capillary used in the experiment. Though the viscosity cannot be calculated from the observed rates of flow, this behaviour of helium II is very striking.

K. S. G. D.

* * *

Rapid Electro-deposition of Iron from Ferrous Chloride Baths.—Charles Kasper (*Jour. Res. of the National Bureau of Standards*, 1937, **18**, 535) describes the results of a study of the conditions necessary to obtain deposits of ductile iron such as are necessary for the plates used in printing currency and securities.

The chief factors investigated were the composition and p_H of the baths, the diaphragm employed and the temperature and current density at which the electro-deposition was carried out.

The bath should be 4 to 5 N with reference to ferrous chloride and should be nearly free from ferric salts, as otherwise cathode efficiency is lowered and in addition brittle deposits are obtained.

Satisfactory ductile deposits are obtained from a bath containing 5 N. Ferrous chloride and 0·10 N hydrochloric acid at a temperature of 106° C. and a current density of 20 amp./dm^2. Harder deposits are finer grained and contain more oxygen than the softer deposits.

Two microphotographs are given to illustrate the nature of the deposits obtained under different conditions.

K. R. K.

* * *

Study of the Crystal Behaviour of Hydrocarbons.—Robert T. Leslie and Wilson W. Heuer (*Jour. Res. of the National Bureau of Standards*, 1937, **18**, 639) present the results of a study employing a microscope of the growth of crystals at low temperatures with a view to correlate crystal habit with molecular structure, if possible. The crystals of nine aromatic, six cyclo-paraffinic, eight normal paraffinic and five branched-chain hydracorbons were obtained and their microphotographs are reproduced. They found that successive members of a homologous series did not differ in crystal appearance, and that condensed molecules tended to crystallise in polyhedrons of roughly equal dimensions, whereas molecules with long chains tended to crystallise in long prisms.

It is concluded that the chief constituents of a mixture of hydrocarbons can be identified by a study of the crystal behaviour of the mixture in conjunction with its other physical properties.

K. R. K.

* * *

The Sandal Leaf Wax.—Although the sandalwood tree is a root parasite, it contains an essential oil in the heart-wood known the world over. A great deal of our present knowledge on the composition of this valuable species is due to the intense researches carried out at Bangalore with particular reference to spike-disease. In a recent contribution, Chibnall, Piper, Mangouri, Williams and Varadaraja Iyengar (*Biochem. J.*, 1937, **31**, 1981–86) have examined the composition of the wax, which has been prepared in a simple way from fresh sandal leaves. The various components isolated, have been identified through X-ray analysis which has been highly developed for wax studies. The position of the polar groups in them also was determined by this means.

The wax itself is a pale yellow solid (m.p. 86° C.) and yields an acid (m.p. 80·5° C.) on saponification. The unsaponifiable fraction forming nearly 75 per cent. of the wax is made up of a mixture of two primary alcohols to the extent of 50 per cent. (75 per cent. *n*-octacosanol and 25 per cent. *n*-triacontanol approximately). The more interesting part of the unsaponifiable fraction lies in the complete absence of paraffins and in the occurrence of palmitone, a new ketone $C_{15}H_{31}\cdot CO\cdot C_{15}H_{31}$ to the extent of 44 per cent. and of a new ketonic

secondary alcohol 6 per cent. *d*-10-hydroxy palmitone $C_{15}H_{31}\cdot CO\cdot C_5H_{10}\cdot CH\cdot OH\ C_9H_{19}$, the first representative of a new group of wax products. In view of the abnormally low percentage of the last product, the position of the alcohol and ketonic groups was fixed by X-ray analysis since the same could not be conveniently determined through chemical methods. This paper is of further interest in that the synthesis of some of the compounds (a few milligrams) has been carried out with considerable skill. Three new compounds have been prepared in addition. The contributors to this paper hail from three different laboratories, two in England and the third, *viz.*, the Indian Institute of Science.

* * *

Lunar Periodicity in *Platynereis*.—The first account of regular lunar periodicity in an Indian Polychæte is given by Gopala Aiyar and Kesava Panikkar in a paper on the swarming habits of *Platynereis* sp. in the Madras Harbour (*Proc. Ind. Acad. Sci.*, (B), 1937, **6**, 245–260). The authors report that the heteronereids of this worm swarm in the Madras Harbour during the new moon in the months of March, June and September. A point of particular interest is that the swarming does not take place on all new moons between March and September; but a regular periodicity is seen in that three lunar months elapse between any two successive swarms. Slight variations may occur in that the highest intensity of the display may be reached on the new-moon day, the day previous or the day after. Swarming takes place in the night between 7 and 10 P.M. and the time corresponds to the period of maximum high tide. Detailed accounts are given on the behaviour of the worms during swarming and a comparison is instituted with other instances of lunar periodicity among Polychætes observed in different parts of the world.

* * *

Some New South Indian Batrachia.—Prof. C. R. Narayan Rao (*Proc. Ind. Acad. Sci.*, (B), 1937, **6**, No. 6, 387) describes some anuran adult and larval forms belonging to the families, Ranidæ, Bufonidæ, Rhacophoridæ and Microhylidæ collected by the members of the staff and students in their various Zoological Expeditions into the Malnad and hilly areas of South India. The material has yielded a large number of new forms. The following forms are described:

1. *Rana parambikulamana* n. sp. (sub-genus *Tomopterna*);
2. *Rana leucorhynchus* n. sp. (sub-genus *Tomopterna*);
3. *Rana intermedius* n. sp. (sub-genus *Hylorana*);
4. *Rana sauriceps* n. sp. (sub-genus *Hylorana*);
5. *Rana tenuilingua* n. sp. (sub-genus *Discodeles*);
6. *Nyctibatrachus sylvaticus* n. sp.
7. *Nannaobatrachus kempholeyensis* n. sp.
8. *Bufo brevirostris* n. sp.
9. *Philautus charius* n. sp.
10. ,, *elegans* n. sp.
11. ,, *koltigeharensis* n. sp.
12. ,, *swamianus* n. sp.
13. ,, *melanensis* n. sp.
14. ,, *narainensis* n. sp.
15. ,, *longicrus* n. sp.
16. ,, *montanus* n. sp.
17. *Ramanella minor* n. sp.
18. ,, *triangularis rufeventris* n. sp.
19. ,, *mormorata* n. sp.
20. ,, *anamalaiensis* n. sp.

Tadpoles of *Philautus leucorhynchus*
,, ,, *hypomelas*
,, ,, *nassutus*
,, ,, *pulcher*
,, ,, *variabilis*

Bufo brevirostris and *Rana aurantiaca*, are also described.

The type specimens are preserved in the Zoology Museum of the Central College, Bangalore.

* * *

Genetics of *Galleria*.—A new one in the form of the moth *Galleria mellonella* has been added to the list of animals which lend themselves to genetic experimentation; Thomas L. Smith (*Genetics*, January 1938, **23**, No. 1,) has found this moth well adapted to laboratory conditions in that it is viable, easily cultured, prolific and breeds the year round. The species is very stable genetically as no mutations are noticed in untreated stocks. X-rays, however, are capable of producing mutations which are found to act as autosomal recessives. Of the two hundred abnormalities produced by irradiation, over thirty are mutants. An interesting case of linkage between the genes of light body colour and rolled scales has been found, with about 2 per cent. crossing-over. Crossing-over probably takes place only in males. The chromosomes are small and their diploid number is 60. Occasionally gynandromorphs, arising from X- and Y-bearing binucleate egg fertilised by two X-bearing sperms, are met with. Facultative parthenogenesis has been observed in about 10 per cent. of isolated virgin females.

* * *

The Constitution of Kellins from *Ammi visnaga*.—Ernst Spath and Wilhelm Gruber confirm (*Ber.*, 1938, **71**, 106) the formula ascribed by Fantl and Ibrahim Salem (*Biochem. Zeit.*, 1930, **226**, 166) to kellin $C_{14}H_{12}O_5$ isolated from the fruit of *Ammi visnaga* and its degradation product kellinone $C_{12}H_{12}O_5$. Kellins has been shown to be 1-methyl-3: 6-dimethoxy-4: 5-furano-chromone and kellinone to be 2: 5-dimethoxy-6-hydroxy-3: 4-furano-acetophenone. Kellinone gives a quinone $C_{10}H_8O_5$ on treatment with nitric acid and on ozonisation and oxidation an acid which on removal of carbon dioxide and ethylation was found to be identical with 2: 4-diethoxy-3: 6-dimethoxy-acetophenone. Kellins has also been obtained by heating kellinone with sodium acetate and acetic anhydride and subsequent hydrolysis with soda solution.

S.

The Central Board of Irrigation in India.*

THE *Annual Report* of the Central Board of Irrigation for 1935-36, which was recently issued, is the second of its kind published by the Board since it was established in November 1930. During the last six years of its existence, the Board has extended its activities in many directions and has helped the Government and the public in many ways. We cannot do better than quote the following from the speech delivered by His Excellency the Viceroy, at the opening of the Proceedings of the Board's Annual Meeting on 31st December 1936.

"The Board and the Bureau have done work of the utmost value in the brief six years since their establishment in November 1930. The Board has provided several sub-committees to investigate important technical problems, not the least important of which has been the Committee on the Distribution of the Waters of the Indus and its Tributaries. . . . The recommendations of that Committee are still under consideration, in consultation with the Local Government and the States concerned but I am glad to be able to say that there is every hope that a solution of this very complex and thorny question will be found along the lines proposed by the Committee. . . . . .

"The Bureau has built up a valuable library of publications at the moment numbering more than 4000. The importance of an authoritative Reference Library of this character and on this scale, needs no emphasis from me. The Board has too established contact with all the important irrigating countries of the world, and it includes in the range of its association, engineering institutions, societies, colleges and eminent engineers in many different countries. I feel confident that as time passes this Institution will prove itself in an increasingly marked degree a clearing house of the first importance for information on irrigation matters not only in India but in all countries where irrigation is of any importance."

Apart from the annual meeting which is generally held in November every year, the Research Committee of the Board meets every year in June or July and considers the research activities of the various irrigation research institutions maintained by Provincial Governments. The present publication gives in outline, the different lines of research work carried out by these institutions. We shall here refer briefly to the most important of these :—

Bombay Presidency.

Researches on irrigation problems are carried out by the "Irrigation Research Division," Poona.[1]

1. *Experiments with a model of the Ganges and the Hardinge Bridge on the Eastern Bengal Railway.*—This bridge spanning the River Ganges near Paksey on the Eastern Bengal Railway was constructed between 1910 and 1915. In September 1933 after floods, when the discharge had reached 17 lakhs cusecs the Right Guide Bank was severely attacked and breached. These experiments were set up to investigate the cause of these breaches and to suggest means of averting them in future.

2. *Fall Experiment.*—Different types of falls have been tried and their relative efficiencies found.

3. *Silt Control at Offtakes from Alluvial Rivers—Experiment with a Model of the Nara River at Mithrao (Sind).*—On the control of silt entering the head-works of a canal system depends largely the success of that system. These experiments will prove of great use for the design of head-works on alluvial rivers.

This station is also doing experiments on soil research.

Punjab.

Irrigation researches here are conducted by the Director, Irrigation Research, who has, besides the well-equipped laboratories at Lahore, a number of research stations spread all over the Province. One of the outstanding works of this Institute in the year under review is mentioned in the following resolution of the Board :

> "*Resolution* : This Board accepts the recommendation of the Research Committee to the effect that the draft publication entitled 'Design of Weirs on Permeable foundations' by R. B. A. N. Khosla, Dr. N. K. Bose and Dr. E. McKenzie Taylor be issued as a Board Publication."

Prevention of Seepage from Canals.—Experiments are being carried out here for the production of impermeability in the bed of a channel by chemical means. It is claimed that the treatment of small length of channels with sodium carbonate has reduced their permeability by 50 per cent.

Problem of Silt Movement and Design of Channels.—It appears that the silt that moves on the bed of a channel is now recognised as one of the hydraulic data of the channel such as the discharge, hydraulic mean depth or the slope. This is a move in the right direction and it is stated that as a consequence of the work done at Lahore, "regime relationships have been developed and it is now possible to introduce silt into the formulæ and record the silt as in the case of other hydraulic data".

A series of interesting experiments have been carried out on the determination of the chemical composition of the various river silts and their possible influence on soil fertility. It has been found that none of the Punjab river silts contains very much nitrogen, phosphate or potash and therefore they cannot be regarded as direct fertilisers.

This conclusion seems to be different from those that are reported to have been experienced from the Ganges or Nile silt.

United Provinces.

Laboratory research on irrigation problems seems to have started here in the year under

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* "Annual Report of the Work of the Central Board of Irrigation India, 1935-36," Manager of Publications, New Delhi, 1937, p. 138.

[1] This hydrodynamic research station is no longer run by the Bombay Government. It is now under the control of the Government of India. Mr. C. C. Inglis is the present Director.

review—a small flume in which experiments on model of the Sarda Barrage at Banbassa and the Deoha Barrage at Duni was conducted to devise the form of protection for down-stream scour.

Problems of seepage loss from canals and experiments to devise means to stop it are also being tried here.

It is interesting to note that Mr. Lacey's theory of flow in alluvial channels has been adopted for future work in the United Provinces. This is perhaps the first time that Mr. Lacey's theory has been given official recognition. This experiment of replacing Kennedy Diagrams by Lacey Diagrams will be watched with interest.

SIND.

Here researches on irrigation problems are carried out by the Development and Research Division. A number of model experiments on different hydraulic structures appears to have been carried out systematically and more or less, on conventional lines.

Here again, Lacey Theory is being put to the practical test. Data from seven regime sites were analysed with a view to see how the equations derived therefrom agreed with those of Lacey's. Certain relationships between different hydraulic constants obtained from these channels have been worked out by the method of least square. Agreement in certain cases is quite good. Determination of seepage loss from the bed of the canals is also being carried out here and treatment with sodium carbonate is also being tried.

From the *Report*, it is apparent that the irrigation engineers are becoming conscious of the fact that problems of irrigation should be tackled exactly on the same lines as any other scientific problem and not on empirical lines as was the case previously. In this respect, Lahore appears to have gone ahead of every other province. Here the whole irrigation research is conducted by a band of scientists who must be working in close co-operation with engineers as is evident from their publication on "Design of Weirs on Sand Foundations". This is indeed the right spirit where the scientists should be left free to develop the technique and arangements of the experiments, the interpretation of the results to be done conjointly with the engineers.

A comparison of the two *Annual Reports*—the first one and this one, will show how irrigation research has developed. On the hydraulic side, model experiments in flumes have become the usual thing, experiments on river models are coming to the front and practical irrigation problems such as seepage losses from canals, movements of silt in canal and their control at the head-works are being recognised as being amenable to scientific treatment. Indications are evident that irrigation engineers are coming to recognise the help that they can derive from scientists and are not reluctant to utilise it.

It is a pity that this spirit of scientific research in irrigation problems has touched only a few provinces. Other provinces such as Bengal and Madras where scientific investigations on purely academic lines are so intensively pursued should not lag behind. It is hoped that irrigation engineers in these provinces will lose no time in attracting some of these scientific workers to irrigation problems on whose proper solution depends much of the prosperity and wealth of the country that they serve.

The Conference of Medical Research Workers in India.

THE Fifteenth Conference of Medical Research Workers in India was opened by His Excellency the Viceroy at the Imperial Secretariat, New Delhi, on 29th November 1937. In his address, His Excellency briefly reviewed some of the outstanding health problems of India, making particular mention of those connected with malaria, tuberculosis, cholera, maternal mortality and nutrition and stressed the importance of medical research from the point of view of the health and happiness of the people. In recalling that Indian medical research workers were the inheritors of a most distinguished tradition, His Excellency emphasised the necessity for maintaining the work at its previous high level and expressed the hope that research into the many problems of health existing in India would commend itself to private munificence.

After His Excellency withdrew, Major-General E. W. C. Bradfield, Director-General, Indian Medical Service, in the course of his address referred to a number of important events that had taken place during the year. The establishment of the Central Board of Health, he said, was an event of great significance, as that body would provide an opportunity for periodical consultations between the Central and Provincial Governments and Indian States in the framing of common policies regarding public health and for the interchange of information, the result of varying experience.

As regards research work, the contributions made by Indian research workers in regard to the elucidation of the cholera problem had received the commendations of the Office Internationale d'Hygiene Publique. As regards the danger of the importation of yellow fever into India, the Government were taking a strong stand and, as a result of Notification dated September 1936, the entry into India of æroplanes and of individuals from infected and suspected yellow fever areas is now under strict control. Further, protective measures, which were being taken at the Karachi Airport, were nearing completion.

India sent a strong delegation to Java to the Rural Hygiene Conference organised by the League of Nations for the Far Eastern Countries. Many of the recommendations made by this Conference were considered by the Research

Workers' Conference and suitable action was suggested.

The Conference conducted its business by referring all the major heads of research to separate advisory committees. These committees considered in detail research work carried out during the year and proposals for the following year and then made specific recommendations to the Conference, which in its turn recommended them for the consideration of the Scientific Advisory Board of the Indian Research Fund Association.

Cholera.

The Cholera enquiry, which has been in progress for about four years, constitutes a combined study by several research laboratories in India, including the Central Research Institute, Kasauli, the All-India Institute of Hygiene and Public Health and the School of Tropical Medicine at Calcutta, the King Institute, Guindy, and the Pasteur Institute, Shillong. During the year, a great deal of fresh knowledge has been gained about the cholera vibrio and considerable progress made in connection with its identification and differentiation from other related organisms. Side by side with the laboratory studies an extensive field study has been in progress on the epidemiology of cholera in Bengal, which is recognised as an endemic home of the disease. In addition, a statistical study of cholera mortality figures has differentiated the endemic from the non-endemic areas in that province, in the hope that the application of the new methods of study, which laboratory research has suggested, might elucidate some of the hitherto unknown factors concerned in the periodic spread of this disease.

Tuberculosis.

Research into the problems of tuberculosis has been in progress in Bengal for some years under the auspices of the Indian Research Fund Association. During the year tuberculosis in relation to industry was studied in one of the large Calcutta jute mills, with a labour force of about 5,000.

A study of the contacts of tuberculosis patients, particularly children, has brought out the interesting fact that tuberculosis constitutes a cause of sickness and mortality among children to an extent hitherto unsuspected.

Finally, an inquiry into the incidence of the disease among the hill tribes near Kalimpong in Darjeeling District revealed the fact that tuberculosis was spreading fairly rapidly amongst these primitive people.

Nutrition.

The nutrition researches carried out at Coonoor during the past twenty years have gained world-wide recognition. During the past two years this work has been extended in many new directions. Surveys of diets and the state of nutrition have already been carried out in certain parts of Madras Presidency, Mysore State and Kashmir and similar investigations have been planned for the coming year in Delhi Province, the United Provinces, Madras City, the Central Provinces and Orissa. The results of these surveys should provide a practical basis for the adjustment of local agricultural policy to nutritive requirements, a point which was stressed both by Sir John Russell and by Dr. N. C. Wright in their recent reports.

The addition of skimmed milk to the diet of growing children has been shown to be of great value, but to feed a child with 8 ounces of skimmed milk a day costs about 12 annas a month which is a large sum in relation to the income of many millions of people in this country. The benefit of skimmed milk appears to be mainly due to its calcium content. The administration of calcium, on the other hand, has been estimated to cost only about an anna per month per child and this, it is considered, should not be beyond the means of a large part of the population.

Clinical tests carried out in the Madras Ophthalmic Hospital, in association with the nutritional laboratories at Coonoor, point to the conclusion that red palm oil is as effective as cod liver oil in the treatment of eye conditions caused by deficiency of vitamin A in the diet. The price of red palm oil is very much less than that of cod liver oil and the corollary would seem to be that the cultivation in India of the red palm should be taken up in order that cheap supplies of this important protective oil should be made available.

Another research, which promises very useful results, relates to the formulation of objective standards for the assessment of malnutrition. A standard based on the measurements of the arm, chest and hip has been introduced in America. Indices based on Indian data are now being evolved and these should prove useful, particularly to school medical officers and other workers engaged in the task of estimating the degree of malnutrition among Indian children.

Maternal Mortality.

Research into the problems of maternal mortality has been approached from two standpoints, (i) that of making surveys in urban and rural areas for determining the causes of maternal deaths and (ii) that of detailed study, by laboratory and field investigations, of the primary causes of the large numbers of deaths due to child-birth, which these surveys disclose. With these ends in view, a survey has been completed in Calcutta, two others are in progress in Bombay City and in a rural area in Bihar, while it has also been suggested that the rural Health Units, which have been established in different parts of India, should be utilised for similar surveys in relation to rural conditions.

The Calcutta inquiry, which has been completed has brought out the fact that anæmia associated with pregnancy and eclampsia are important causes of mortality, and an investigation into the factors responsible for anæmia in pregnant women was started in July 1937. Another inquiry relating to anæmia amongst women employed in the tea plantations of Assam has been in progress during the year. These inquiries have been recommended for continuance. Other inquiries, which have been recommended, are an investigation relating to eclampsia and a study of the bacteriology of the genital tract which is of importance in relation to the question of sepsis during child birth.

MALARIA.

The Indian Research Fund Association maintains the Malaria Survey of India, an institution concerned with the study of the problems of malaria in India and with the training of workers in malarial research and prevention. The Malaria Survey also conducts every year a course of training, which is attended by medical officers from all parts of India. In addition it has organised and directed the antimalarial campaign in Delhi. This work has, within the last year, produced excellent results giving promise of considerable reduction if not complete elimination of the disease in and around Old and New Delhi.

The researches carried out by the Malaria Survey of India included an investigation in Kutch into the bionomics of *A. culicifacies* and *A. stephensi* in relation to the transmission of malaria; an intensive study of the bionomics of the local malaria carrying mosquitoes in Delhi; a large-scale experiment to determine the value of insecticidal sprays in the control of malaria; and a study of the feeding habits of malaria carrying anophelines.

Blackwater fever is a disease which has hitherto eluded research both in regard to causation and methods of treatment. Very interesting work in this direction has been in progress at the All-India Institute of Hygiene and Public Health and a new line of treatment is reported to have given encouraging results.

The need for making cheap quinine treatment available to the people has been repeatedly emphasised by the Research Workers' Conference for some years, and on this occasion, the Conference noted with satisfaction the action taken recently by the Indian Research Fund Association to institute an enquiry into the cultivation of chinchona in India with this end in view.

A large number of minor enquiries of which it is not possible to give details in the course of this very brief note, came under discussion at the Conference. Many of these are being conducted at university and college laboratories in different parts of India. The I.R.F.A. has always been willing to recognise the importance of associating research work with institutions and colleges concerned with the training of medical students and medical post-graduates. The large number of enquiries which the Association has financed during the past years at the Calcutta School of Tropical Medicine, at the All-India Institute of Hygiene and at various universities is evidence of the Association's policy in this direction.

His Highness the Maharaja's Observatory, Trivandrum.*

HIS HIGHNESS THE MAHARAJA'S Observatory, Trivandrum, was founded in 1837 during the illustrious reign of His Gracious Highness Sri Swati Thirunal Maharaja of Travancore, a great patron of Science and Arts. The Observatory is one of the oldest in India and its first astronomer was Mr. John Caldecott, who was, prior to his appointment as Director of the Observatory, the commercial agent of the Government of Travancore at Alleppey. The present site was chosen as the best available in the town of Trivandrum being 200 feet above sea-level and commanding a good view of the horizon.

Mr. Caldecott's original proposal was to establish an Astronomical Observatory, and he got down for this purpose a few astronomical instruments; but when the institution started work in 1837, greater attention seems to have been paid to meteorological observations. Mr. Caldecott published three issues of an astronomical ephemeris adapted to the Meridian of Trivandrum. After the death of Mr. Caldecott, Mr. John Allan Broun, who, till 1849, was the Director of the Magnetic Observatory, Makerstoun, Southern Scotland, was appointed Director of the Observatory and he took charge of the institution in 1852. Finding that there was good scope for work on Terrestrial magnetism in Trivandrum, he started a scheme of investigations on magnetism and meteorology. As a result of his observations, Mr. Broun showed that the Sun and the Moon exerted an influence on the direction of the magnetic needle and that a lunar diurnal variation existed for this influence. Near the equator the influence in December was the opposite of what it was in June. He also showed that the lunar action was reversed at sun rise, and was much greater during the daytime than at night, whether the moon was above or below the horizon. Mr. Broun also deduced that the day-to-day changes in the horizontal force of the earth's magnetism was simultaneous all over the world. Some of these changes he attributed to the moon, while the others had periodical changes once in 26 days, on account of the influence of the Sun. He also inferred that the greater magnetic disturbances were due to actions proceeding from certain meridians of the Sun.

Mr. Broun showed that the apparent simultaneity of the changes of mean barometric pressure over a great part of the globe, had a period of 26 days. He started systematic observations of the clouds at different altitudes. He also found certain relations between atmospheric motions and the directions of the lines of equal barometric pressure.

It is a noteworthy fact that Mr. Broun also established an Observatory on the top of Agustia peak at a height of 6,200 feet above the sea-level.

* The centenary of the foundation of H. H. The Maharaja's Observatory was celebrated in a fitting manner on the 23rd December 1937. A brief history of this great institution is given here. A more detailed account can be obtained from the Centenary Volume which is now in the press.—*Editor.*]

This is the most conspicuous peak of the western ghats that could be seen from any part of Trivandrum, and in this work Mr. Broun had to overcome great difficulties arising from weather conditions and in exploring a thick forest abounding in wild animals. With the observations carried on in this place and at intermediate stations ranging in altitude from 6,200 feet to sea-level he deduced the effect of height on the diurnal variation of atmospheric pressure.

Mr. Broun continued his work till 1865, when he went to England. At the suggestion of the Governor of Madras (Sir William Denison) the magnetic observatory was later closed. Mr. Broun devoted the rest of his life for publishing the "Trivandrum Observations on Magnetism and Meteorology". Although only one volume of this was published during his life-time, Mr. Broun's complete works were published in the *Transactions of the Royal Society of Edinburgh and London*, and also in the *Indian Meteorological Memoirs*. In recognition of his meritorious work Mr. Broun was awarded the Keith Prize and Medal of the Royal Society of Edinburgh for 1859–61 and the Royal Medal of the Royal Society of London in 1878.

After the retirement of Mr. Broun the working staff of the Observatory was considerably reduced, and a few meteorological observations were continued up to 1892, when Dr. Mitchell, Professor of Mathematics in H. H. The Maharaja's College, took charge as Honorary Director of the Observatory. He intensified the recording of Meteorological data and organised a scheme of rainfall measurement for the whole State and was responsible for compiling a few important tables of meteorological information. It is worthy of note that Dr. Mitchell, after his retirement from Travancore in 1912, served as Director of the Magnetic Observatory at Eskdalemuir and has carried out valuable work on "Sudden Commencements" of magnetic storms, and has recently been the receipient of the Keith Prize and Medal of the Royal Society of Edinburgh for his researches.

In 1910 Dr. Mitchell was succeeded by Mr. J. Stephenson, Professor of Physics, H. H. The Maharaja's College as Director of the Observatory. He continued the work started by Dr. Mitchell till 1920. During the latter part of Mr. Stephenson's time, he had also an assistant director Mr. M. Rama Varma Raja, an enthusiastic worker, who put into working order some of the astronomical instruments that remained unused before his time. During the period 1916–19, Mr. Raja published an astronomical ephemeris. In 1920 Mr. (now Dr.) K. R. Ramanathan, Lecturer in Physics, H. H. The Maharaja's College, Trivandrum, succeeded Mr. Stephenson as Director. He arranged for the normals of a large number of meteorological elements being computed up-to-date and also investigated on the Thunderstorm activity in Trivandrum. In 1922 Mr. V. Sivaramakrishna Iyer succeeded Mr. Ramanathan as Honorary Director. Self-recording instruments for the registration of pressure, temperature, humidity, wind velocity and rainfall were installed in 1922, and this institution has been recognised as a first class meteorological station by the Meteorological Department of the Government of India from 1922 onwards.

In 1927 Government considered the necessity of reviving the astronomical activity of the institution and appointed Dr. H. Subramani Aiyar as Government Astronomer in charge of the Astronomical Department and placed Professor V. Sivaramakrishna Iyer in charge of the Meteorological Department.

In 1928 balloon observations were started under the technical supervision of the Meteorological Department of India. The results of the daily observations are communicated to the Meteorological Office and published by the upper air observatory, Agra. From May 1937 a weather station has been started at the Alleppey Pier, under the technical supervision of the Meteorologist. The opening of a similar station at Cape Comorin is also under the consideration of Government. Besides furnishing weather data for forecasting centres, this observatory publishes a daily weather report for local use, and also supplies data for pilots landing at the Trivandrum Aerodrome.

After the starting of the Astronomical Department, weekly publication of astronomical notes giving the position of the Sun, the moon and the planets for Trivandrum mean noon, was undertaken. This has been recently changed by order of Government to an advance annual publication forming the first part of the Government Almanac and Directory from 1938.

The equatorial Telescope purchased during the time of the late Mr. Caldecott has been housed properly and located favourably for surveying the sky. A revolving dome will be constructed in the near future, and the astro-camera mounted in a satisfactory manner.

This is briefly an account of the working of this institution since its beginning a hundred years ago. Important and impressive as its record of work has been, one looks forward to even greater achievements. Under the patronage of the enlightened Ruler of Travancore and His Highness' Queen Mother there is little doubt that the usefulness of the Observatory will be greatly enhanced and Trivandrum bids fair to become a centre of instruction and research in observational Astronomy.

SCIENCE NOTES.

Upendra Kumar Das.—We regret to have to announce the death at the early age of 35 years of Dr. Das, Research Associate in-charge of the Biochemical Laboratory at the Experiment Station of the Hawaiian Sugar Planters Association. Dr. Das was instantly killed by an explosion of apparatus in his laboratory on October 22, 1937.

His contributions to the sugarcane agriculture were substantial and conspicuous. His work covers a wide field and includes cane quality, juice quality and sugar mill by-products. His passing away at an early age, when fully equipped for research of a high quality has deprived the sugar industry of a practical scientist.

* * *

The Ananda Temple of Burma.—What is likely to be the last contribution relating to Burma published by the Archæological Survey of India has just been released. It is a monograph on the Ananda Temple at Pagan in Burma in the series of memoirs published by the Archæological Survey of India on the ancient monuments of India and Burma.

Pagan, it may be noted, is the most famous Buddhist Centre in Burma and among the hundred temples at the place there is no one which can equal Ananda as a religious monument or as a store-house of inscriptions and sculptures. The date assigned for the foundation of this temple is 1090 A.D. in the reign of King Kyanzittha whose zeal and piety led to the adoption of Buddhism as the Burmese national faith.

Like the religion of the land which came from India, the architecture of this and other Burmese temples, too, bears the stamp of Indian genius and craftsmanship. Internally the Ananda temple is massive with solid walls of enormous thickness. Colossal standing images of the Buddha are enshrined in recesses on each side of the central mass of brickwork. Another peculiar feature of the temple is the frieze of glazed terracotta plaques which are embedded in small panels in the plinth around the temple.

* * *

The Government of Travancore have sanctioned the formation of a Museum of Antiquities at Padmanabhapuram, to preserve the inscription stones, carved and sculptured pillars, images, etc., and other relics of antiquity. While the Padmanabhapuram collections will be mainly of archæological and historical interest, collections with an artistic appeal will be housed in Trivandrum. The Padmanabhapuram Palace, it is understood, will be declared a protected monument under the Ancient Monuments Preservation Regulation.

* * *

Plastics from Fixed Glycerides.—Oils have been converted into products resembling lubricating greases, waxes and resins. By a further modification of the process, the same materials have been tansformed into a powder with thermo-plastic and thermo-hardening properties. The conversion of fixed glycerides of this type into the products enumerated above, is an entirely new observation due to Dr. M. Goswami, Department of Applied Chemistry, University of Calcutta. The process depends upon three factors:—(1) presence of catalysts, (2) definite temperature, (3) definite pressure. The nature of the final products—soft, hard and resinous—is determined by a variation in these three factors. The possibilities of this process from an industrial standpoint, are very great as India is rich in oils of all types and is at the present time, entirely dependent upon foreign supplies for the synthetic plastics, resins and lubricating greases of a superior quality. All the ingredients are found in abundant quantities in India and no imported raw material appears to be necessary for the process.

* * *

Marketing of Ghee.—An important step to ensure the marketing of genuine ghee has been taken by the Government of India. The merchants dealing with ghee, are required to maintain a fully-equipped ghee testing laboratory and suitably qualified staff approved by the Government. Raw ghee received from the villages, is to be tested and clarified. After examination by the merchants' analyst, samples are drawn and sent to the Government *Agmark* Laboratory at Cawnpore. The ghees satisfying all the chemical requirements laid down by the Ghee Conference are to be placed in suitable containe s which will be marked with special seals issued by the Agricultural Marketing Adviser. Ghees will be marketed in four grades, *viz.*, 'Cow', 'Buffalo', 'Special' and 'Genuine'. The seals are printed on a special paper which can stand pasting only once and cannot, therefore, stand removal from a container and repasting to another. The seal as well as the soldered part of the bung are covered with a special protecting coating which renders the seal waterproof. Coatings of different colours which are inflammable are used for different grades of ghee. Each tin is marked with the name of the packing station and the number of the melt, so that its identity and other particulars can be traced back easily for the purpose of checking. Thus, all possibilities of unscrupulous adulteration of ghee are sought to be prevented, and the interests of consumers, safeguarded.

* * *

Indian Central Cotton Committee.—Marketing survey of cotton for all India was one of the principal subjects which came up for discussion at the 36th half-yearly meeting of the Indian Central Cotton Committee, held in Bombay on the 25th and 26th January 1938, under the presidentship of Sir Bryce Burt, C.I.E., M.B.E., I.A.S., President of the Committee. The scheme was prepared by the Agricultural Marketing Advisor to the Government of India, following upon the decision of the Committee at its meeting held in August last year. Side by side with this a scheme for cotton marketing survey in the Punjab proposed by the Director of Agriculture, Punjab, on the lines of surveys of other crops initiated by the Imperial Council of Agricultural Research was also discussed. The Committee decided that the Punjab scheme should be circulated to

commercial bodies for an expression of opinion. It was resolved that the proposed scheme for a marketing survey of cotton in India be also circulated among commercial bodies in the first instance.

Prior to the meeting of the full Committee, various Sub-Committees had made a detailed and critical examination of many important problems concerning the cotton grower, the trade and the cotton industry and made reports thereon for the consideration of the full Committee.

The Committee accorded its approval to the report of the Agricultural Research Sub-Committee, which had reviewed the progress reports of a series of research and seed distribution schemes already operating in the provinces. It also considered several new research and seed distribution schemes proposed by them in pursuance of its programme for the improvement of cotton in India. Among the schemes reviewed was the Punjab Physiological (Cotton Failures) Scheme which was sanctioned for the purpose of investigating the causes, which led to the partial failures of cotton crop in the Punjab, and Dr. Mason's report on the working of the scheme. The Committee was gratified to note the valuable suggestions made by Dr. Mason which should bring the scheme to fruition. The Committee expressed its obligation to Dr. Mason and to the Empire Cotton Growing Corporation, which had placed so eminent an expert at the disposal of the Committee.

The question of acquiring wider markets for Indian cotton, received considerable attention of the Special Sub-Committee which met earlier. The Report of this Sub-Committee was considered by the full Committee and approved. With a view to keeping close contact with the foreign demand for Indian cottons, it was decided to circulate the trade associations monthly reviews received from the Director-General of Commercial Intelligence and Statistics.

* * *

Indian-built Plane.—The first aeroplane built at the Aeronautical Training Centre of India, New Delhi, under the direction of Captain A. T. Eadon and approved by the Air-Ministry, made its first successful flight on 28th January. The machine was piloted by Captain R. Pierce, and broke the speed record for its class, attaining 155 miles per hour. The pilot in an interview to the *Associated Press* said, "It was indeed a proud moment for me to fly for the first time in the first approved training machine made in India. The young Indian cadets had devoted one year to building this machine and it was a thrilling experiment to see our labours so successfully crowned." The machine is of the Miles Training type, an M.2.R. low-wing monoplane with a DeHavilland 130 H.P. engine.

The Aeronautical Training Centre of India is in a position to turn out air craft not only to cope with the expansion of civil aviation in this country, but also for defence purposes. We offer our congratulations to Captain Eadon, a pioneer in the aeronautical education in India.

* * *

Prince of Wales Museum of Western India.—A perusal of the *Annual Report* for the year 1936–37, shows that the popularity of the Museum is on the increase. It has indeed reached a high standard of educational activity not incomparable with that obtained in the museums in N. W. Europe and America. During the year under report significant additions were made to the galleries of the various sections. The Natural History Section has been practically remodelled on modern lines, and if further improvements and additions have not been made, it is solely due to the paucity of funds.

It will be recalled that the Natural History Section was referred to especially at the Conference of the Museum Association held at Leeds in August 1936, where Mr. Markham, the senior author of the *Report* on Museums in India, described its gallaries as amongst the best in the world and worthy of every attention. The research collections in this Section include Mammals, Birds and Reptiles, which are perhaps the most important available to students in the East. It is, however, unfortunate, as the report rightly points out, that these valuable collections are housed under conditions wholly unsuitable and it is hoped that the Government of Bombay will lose no time in providing funds for the proper accommodation of the reference collections, consistent with their importance.

The most outstanding addition to the museum during the year has been the collection of the world famous antiquities excavated at Mohenjo Daro in Sind. Two noteworthy exhibitions in attractive settings in the galleries in the main building are the magnificent art collections of the late Sir Dorab Tata and the important collection of Mughal paintings and fine copies of the Ajanta frescoes of the Rt. Hon'ble Sir Akbar Hydari.

The progress made in the working of the main sections, detailed in the *Report*, is impressive and those in immediate charge of the section and the management of the Museum, deserve the grateful thanks of the public for the valuable instruction so agreeably provided.

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Estimated World Requirements of Dangerous Drugs in 1938.—The Statement issued by the Supervisory Body under Article 5 of the Drugs Limitation Convention of 1931 giving the estimated World requirements of dangerous drugs in 1938 has recently been published by the League of Nations.

The Statement makes provision for the dangerous drugs requirements of every country and territory in the World. The total number of separate administrative units (*i.e.*, countries, colonies, dependencies, protectorates, etc.), for which estimates are given in the document, is 179. In preparing its Statement, the Supervisory Body had to examine estimates for 63 countries and 104 territories. In addition, in accordance with the obligation imposed upon it under the Convention, it established estimates for ten countries and two territories, for which estimates had not been furnished by the governments concerned.

The Introductory Table in the Statement gives a total of estimated World requirements of each drug for medical and scientific purposes for the year. The total amount of morphine required for all purposes (including the amount required for conversion into heroin, codeine and dionine) is 45,638 kilos (as compared with 40,976 kilos in 1937). The amounts of heroin, codeine and

dionine (made principally by conversion from morphine), estimated as required for 1938 are: heroin, 1,133 kilos (as compared with 965 kilos in 1937); codeine, 29,921 kilos (as compared with 25,724 kilos in 1937); dionine, 3,089 kilos (as compared with 3,199 kilos in 1937). The amount of cocaine estimated as required is 5,032 kilos (as compared with 4,976 in 1937). A little over a ton of other drugs is required. Altogether, therefore, leaving aside the factor of conversion, the total amount of dangerous drugs estimated as required for actual use next year is a little over 52 tons.

One of the principal tasks of the Supervisory Body under the Convention is to see that estimates are not excessive and correspond as closely as possible to real needs. In carrying out this task, the Supervisory Body asked for additional information and explanations in the case of eleven countries. Even here, four years' experience has shown considerable progress, since information of this kind was asked for in 1934 from 28 countries, in 1935 from 23 countries, and in 1936 from 18 countries.

Some 53 countries have so far signed the Procès-Verbal drawn up for the purpose of enabling the Statement of the Supervisory Body to be issued on December 1st instead of November 1st; ten signatures are still required before the Procès-Verbal can come into force.

* * *

Short Quinine Treatment for Malaria.—The Malaria Commission of the League of Nations, recommends the short quinine treatment for malaria which consists of taking 15–18 grains of quinine daily during 5–7 days, the treatment being repeated, should there be a relapse. For countries infested with malaria, the short quinine treatment is an invaluable help. Former methods, which consisted of taking quinine over a period of months, have completely given way to the short quinine treatment, thanks to which, the worker is able to continue his work uninterruptedly. For prophylaxis the Commission recommends a daily dose of 6 grains during the whole malarial season.

A country whose population suffers from malaria, is economically much weaker than one with a healthy population. In British India, the number of subjects attacked by malaria every year reaches 100,000,000, and it is reckoned that on account of this disease the British Administration loses about sixty million pounds sterling every year!

* * *

One of the resolutions adopted at the meeting of the **Inter-University Board,** held at Allahabad on 13–14th December 1937, relates to the grants from Provincial Governments for research work in Applied Sciences. The resolution reads:—

"*Resolved* that Provincial Governments be requested to sanction increased grant to Universities for research work in Applied Sciences and also to take steps to ensure increased collaboration between Univerities and Governments in the matter of researches relating to agricultural and industrial problems."

* * *

The *Academia Asiatica* of Teheran, Iran, has conferred on Mr. Benoy Kumar Sarkar, the Honorary Doctorate Degree of Geography, for his contributions to the Economics, Culture and Sociology of Asia. This is the first honorary distinction accorded by the *Academia Asiatica* to an Indian scholor.

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Barcley Medal.—The Royal Asiatic Society of Bengal has awared the Barcley Memorial Medal to Brevet-Colonel R. N. Chopra, Director of the School of Tropical Medicine, for his long sustained and distinguished work in the field of medical research. The award is made biennielly for conspicuously imoportant contribution to medical and biological sciences with special reference to India.

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Mr. Mohd. Afzal Husain, Principal of the Punjab Agricultural College, Lyallpur, left for Geneva to represent India at the Agricultural Committee's meeting of the International Labour Organisation held on 7th February. This Committee is the first of its kind and has been appointed for discussing important problems concerning agricultural workers. Mr. Mohd. Afzal Husain intends visiting various agricultural and scientific institutions on the Continent.

* * *

National Institute of Sciences of India.—At The Third Annual General Meeting of the National Institute of Sciences of India, held on Saturday the 8th January 1938 in the Senate House of the University of Calcutta, the following gentlemen were elected office-bearers and other members of Council for the year 1938:—

President: Prof. M. N. Saha, D.Sc., F.R.S., F.R.A.S.B.; *Vice-Presidents*: Prof. S. S. Bhatnagar, O.B.E., D.Sc., Brevet-Col. R. N. Chopra, C.I.E., Sc.D., M.D., F.R.A.S.B., K.H.P., I.M.S.; *Treasurer*: Dr. B. S. Guha, Ph.D.; *Foreign Secretary*: Prof. B. Sahni, D.Sc., Sc.D., F.G.S., F.R.S., F.R.A.S.B.; *Secretaries*: Prof. S. P. Agharkar, Ph.D., F.L.S.; Dr. A.M. Heron, D.Sc., F.R.S.E., F.R.G.S., F.G.S., F.R.A.S.B; *Members of Council*: Mr. T. P. Bhaskara Shastri, M.A., F.R.A.S.; Dr. G. S. Bose, D.Sc., M.B.; Mr. H. G. Champion, M.A.; Prof. J. C. Ghosh, D.Sc.; Dr. F. H. Gravely, D.Sc., F.R.A.S.B.; Khan Bahadur M. Afzal Husain, M.A., M.Sc., I.A.S.; Prof. K. S. Krishnan, D.Sc.; Dr. R. B. Lal, M.B.B.S., D.P.H., D.T.M. & H., D.B.; Prof. S. K. Mitra, D.Sc.; Prof. J. N. Mukherjee, D.Sc., F.C.S.; Col. Sir Arthur Olver, C.B., C.M.G., F.R.C.V.S.; Dr. B. Prashad, D.Sc., F.R.S.E., F.L.S., F.Z.S., F.R.A.S.B.; Prof. N. R. Sen, D.Sc., Ph.D.; Lt.-Col. S. S. Sokhey, M.D., D.T.M. & H., I.M.S.; Prof. V. Subrahmanyan, D.Sc., F.I.C.; Col. J. Taylor, C.I.E., D.S.O., M.D., D.P.H., I.M.S.; Rao Bahadur B. Venkatesachar, M.A., F.Inst.P.

Prof. M. N. Saha, President of the Institute, delivered his Presidential Address, the subject being 'The Problem of Indian Rivers'.

We have recently received the Annual Report for 1937 issued by the Council of the National Institute of Sciences. Since the Annual Meeting held in January 1937 at Hyderabad, three ordinary meetings, one in Allahabad, one in Calcutta, and the third at Delhi were held. At the Calcutta meeting a symposium on the 'Malaria Problem in India' was organised which was attended by a large number of medical and scientific workers from all parts of India. Four numbers of the

Proceedings, three numbers of the *Transactions* and the second number of the *Indian Science Abstracts* for 1935, were issued during the year. The publications of the Institute are issued free to Universities and similar bodies making annual grants to the funds of the Institute.

The Institute received a grant of Rs. 300 from H. E. H. the Nizam of Hyderabad and a grant of Rs. 6,000 from the Government of India.

The Institute lost 2 Ordinary Fellows, Diwan Bahadur L. K. Ananthakrishna Iyer and Sir J. C. Bose and 2 Honorary Fellows, Lord Rutherford of Nelson and Prof. Albert Heim.

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Indian Chemical Society.—The Annual Meeting of the Society was held on Wednesday, 5th January, at Calcutta with Dr. J. C. Ghosh, President of the Society, in the Chair.

The proposal of the Council to publish the *Industrial and News Edition* of the *Journal of the Indian Chemical Society*, under the joint auspices of the *Indian Chemical Society and the Institution of Chemists* (India), was approved. This publication will be issued quarterly.

Dr. J. C. Ghosh delivered his address on the " Physico-chemical Investigations on Vitamin C ".

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Indian Statistical Institute.—The Madras Branch of the Institute was inaugurated by Prof. K. B. Madhava, on the 15th January. Prof. P. J. Thomas, who has been elected President was in the chair. Prof. Madhava traced the inauguration and development of the Indian Statistical Institute and said that it was the business of the Statistical Societies all over the country to develop schools of thought of great efficiency and integrity—integrity because there was a feeling that statistics could be used to prove anything.

The use of statistics for the formulation of economic and social policy would be the aim of the Madras Branch of the Indian Statistical Institute.

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The Indian Botanical Society.—The 17th Annual Meeting of the Indian Botanical Society was held at Calcutta on January 6th, 1938. The following office-bearers were elected :—

President : Mr. H. G. Champion, I.F.S. (Nainital) ; *Secretary* : Dr. E. K. Janaki Ammal (Coimbatore).

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Association of Economic Biologists.—The Eighth Annual Meeting of the Association of Economic Biologists, Coimbatore, was held on 17th January 1938. The following office-bearers were elected :—*President* : Dr. J. S. Patel ; *Vice-Presidents* : Mr. P. V. Ramiah, and Mr. K. Ramiah.

The retiring President, Mr. K. Krishnamurthy Rao delivered an address on " Science and the Scientist ".

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University of Aligarh.—The Annual Convocation of the University was held on 23rd January, H. H. the Aga Khan, Pro-Chancellor, presiding. A feature of the function was the conferment of the honorary degree of Doctor of Literature on H. H. The Nawab of Rampur. The Marquess of Lothian delivered the Convocation Address.

Donations amounting to Rs. three lakhs, one lakh each from H. E. H. The Nizam of Hyderabad, H. H. The Nawab of Rampur, and H. H. the Aga Khan, were announced.

Sir Zia-ud-din Ahmed, Vice-Chancellor, emphasized the supreme need for establishing a Polytechnic Institute at Aligarh for which Rs. 30 lakhs were needed.

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University of Mysore.—I. *Personnel.*—(1) Dr. J. F. Robinson, B.A., M.D., F.A.C.S., F.R.C.S.E. Principal, Medical College, Mysore, who was on leave from the 22nd June 1937, returned from leave and assumed charge of the Office of the Principal from Dr. D. S. Puttanna, B.A., F.R.C.S.E., L.M., D.T.M. (2) Mrs. H. S. Hensman, M.A., Principal, Maharani's College, was permitted to retire from service from 17th January 1938 and Miss J. M. Black, M.A., appointed Professor of English and Principal, Maharani's College, Mysore.

II. *Lectures.*—(1) *British Delegation.*—The British Delegation to the Indian Science Congress Session held at Calcutta, were invited to visit the University. Two public lectures were arranged, one at Bangalore and the other at Mysore as under :—

Bangalore : Sir A. S. Eddington, D.Sc., LL.D., F.R.S., " The Expanding Universe ".

Mysore : Sir James H. Jeans, F.R.S., " The Furthest Depths of Space ".

Special lectures to college classes were delivered by Professors C. Spearman, E. Barker, in Mysore and by Professor F. A. E. Crew in Bangalore.

(2) *Extension Lectures.*— (i) Mr. B. M. Sivaramiah, Pleader, Nanjangud, delivered a lecture in Kannada (illustrated by lantern slides) at Channapatna on "Evolution of the Sound Screen".

(ii) Dr. M. V. Gopalaswamy, B.A., B.Sc., Ph.D., Professor of Psychology, Maharaja's College, Mysore, delivered a lecture in English on "The Future of the Radio in India " at each of the places, Bangalore and Shimoga.

(3) *Special Lectures.*—Special lectures were given in the Maharaja's College and Central College respectively by Dr. Hermann Goetz, and Dr. R. R. Gates.

III. *Examinations.*—The results of the Medical Examinations held in December 1937 were published. They were as follows :—

	No. Examined	No. Passed
Pre-Medical	30	19
First M.B.B.S.	29	19
Second M.B.B.S. ..	22	13
Final M.B.B.S., Part I ..	27	19

IV. *Academic Council.*—A meeting of the Academic Council was held on the 29th January 1938. Among the decisions arrived at, mention may be made of the following :—

(*a*) Institution of Post-Secondary Diploma Courses. (*b*) Revised detailed courses of study for the B.T. Degree examination. (*c*) Revised courses of study in History for the B.A. (Honours) Degree examination. (*d*) Revised courses of study in Economics for the B.A. (Honours) Degree examination.

V. *Endowments.*—The following endowments have been offered to the University :—

(i) By Mr. B. M. Srikantia, M.A., B.L., Professor of English, Central College, Bangalore, for the

award of scholarships for the encouragement of the advanced study of Kannada in the University: Rs. 5,000.

(ii) By Mr. T. R. Naidu, Bangalore, for the encouragement of the study of Chemistry for a degree among students of the Depressed Classes: Rs. 1,500,

(iii) By the Professor M. G. Srinivasa Rao Memorial Committee, for a prize for Proficiency in Organic Chemistry and another for Proficiency in Sports: Rs. 1,400.

VI. *Recognition of Examinations and Degrees.*—(1) In connection with the question of the recognition of the M.B.B.S. degree of this University by the Royal College of Surgeons, England, Mr. Cecil Wakeley was deputed by the Examining Board of the Royal College to inspect the Medical College. Mr. Cecil Wakeley, Prof. Huggett and Mr. Horace H. Rew accordingly visited the College in January.

Travancore University.—Messrs. Harrison and Crossfield have donated Rs. 12,000 to the Travancore University for the development of Technological Studies.

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Announcements.

It is announced that an authorised biography of Lord Rutherford of Nelson is being prepared by Prof. A. S. Eve. Those who have letters written by Lord Rutherford that might be used, are requested to forward them to him at 26, Willaw Road, Hampstead, London, N.W. 3.

All-India Population and Family Hygiene Conference.—The Second All-India Population and the first Family Hygiene Conference will be held in Bombay from 16th to 19th April 1938 (Easter Holidays). The Office-bearers and sectional chairmen are:

President: Sir Vepa Ramesam; *Executive Chairman*: Lady Cowasjee Jehangir; *Chairman, Reception Committee*: Sir Jehangir C. Coyajee; *Vice-Presidents*: Mr. Jamnadas M. Mehta, Lt.-Col. Jelal M. Shah, and Mrs. How-Martyn; *Vice-Chairman*: Dr. J. S. Nerurkar; *Chairman, Subjects Committee*: Lt.-Col. S. S. Sokhey; *Chairman, Exhibition Committee*: Dr. George Coelho; *Chairman, Entertainment Committee*: Mrs. G. R. Billimoria.

Sectional Chairmen.—

Economics: Mr. P. K. Wattal; *Sociology and Anthropology*: Prof. Radhakamal Mukherjee; *Nutrition*: Lt.-Col. S. S. Sokhey; *Vital Statistics*: Prof. R. B. Lal; *Maternity and Child Welfare*: Begum S. Hamid Ali; *Birth Control and Sterilization*: Dr. V. R. Khanolkar; *Medical Problems*: Lt.-Col. W. C. Spackman; *Problems of Sex*: Lt.-Col. Owen Berkeley-Hill; *Housing and Health*: Dr. A. Y. Dabholkar.

Honorary Secretaries: Dr. A. P. Pillay and Prof. Ghurye; *Jt. Honorary Secretary and Treasurer*: Mrs. A. Thanawalla.

Those desiring to submit papers and members and delegates wishing to attend the Session should apply to the Honorary Secretaries at *No. 8, Ormiston Road, Appollo Bunder, Bombay*, at an early date.

The Second All-India Obstetric and Gynæcological Congress will be held at Bombay from April 13 to 16 next, under the presidentship of Dr. B. D. Mukherji of the Carmichael Medical College, Calcutta. Those who desire to attend the Congress, should communicate early to the Organising Secretary, Raj Bhuvan, Sandhurst Road, Bombay 4. A Medical Exhibition is also being arranged. Those manufacturers who desire to reserve stalls, should inform the Hon. Secretary as early as possible.

The Third International Congress for Microbiology.—The Third International Congress will be held at the Waldorf-Astoria Hotel, New York City, from September 2–9, 1939, under the auspices of the International Association of Microbiologists.

The Congress will comprise the following sections:—(1) General Biology: Variation and Taxonomy, (2) General Biology, Microbiological Chemistry and Physiology; (3) Viruses and Viral Diseases; (4) Rickettsiæ and Rickettsial Diseases; (5) Protozoology and Parasitology; (6) Fungi and Fungous Diseases; (7) Medical and Veterinary Bacteriology; (8) Agricultural and Industrial Microbiology and (9) Immunology.

Dr. T. M. Rivers, Rockfeller Institute for Medical Research, will be the President of the Congress, and Dr. M. H. Dawson, College of Physicians and Surgeons, Columbia University, the General Secretary.

Biological Abstracts.—On October 4, 1937, a circular letter was sent from The Union of American Biological Societies Office to all subscribers in the United States. It advised that *Biological Abstracts* is to be published, beginning with the January issue, 1938, on a self-supporting basis. All institutions, and many individuals, profiting by its service are co-operating in the support of its publication. *Biological Abstracts* is published without profit, to anyone except to the individuals and institutions it serves.

The new basis of publication necessitates a revised scale of charges to all subscribers. The new subscription rate in all countries except the United States will be $ 25·00 per year. In the United States the rates range from $ 25·00 to $ 200·00 per year, depending upon the number of biologists in the various institutions it serves.

The subscription price quoted is below the actual cost of gathering the abstracts and publishing them. In return for this low rate, it is hoped that biologists all over the world will co-operate in furnishing abstracts of their articles to *Biological Abstracts* as so many of them are doing now and have done in the past. A preliminary letter has gone to the Editors of numerous biological journals suggesting a possible basis for such co-operation, and an announcement regarding this will be sent at a later time.

Journal of Morphology.—Beginning from January 1, 1938, the Journal of Morphology, heretofore a quarterly, will be issued bimonthly, on the first of January, March, May, July, September, November. A volume will contian 600 pages, as formerly, and will be issued in three numbers. Two volumes will be published annually. The price is reduced from $ 12·00 per volume to

$10·00 per volume, Domestic; $10·50 per volume, Foreign. This change has been made to meet the demands of the ever increasing number of accepted manuscripts, and to assure prompt publication. Volume 62, no. 1, was issued on January 1, 1938. Address subscriptions to The Wistar Institute of Anatomy and Biology, Woodland Avenue and Thirty-sixth Street, Philadelphia, Pa.

It is announced that available back number and volumes of the following journals will be disposed off at special prices. This offer holds good for a period of four months only commencing from January 1938:—

(1) Journal of Morphology, (2) The Journal of Comparative Neurology, (3) American Journal of Anatomy, (4) The Anatomical record, (5) The Journal of Experimental Zoology, (6) American Journal of Physical Anthropology, (7) Journal of Cellular and Comparative Physiology, and (8) The Journal of Nutrition. Address orders to the Wistar Institute of Anatomy and Biology, Woodland Avenue and Thirty-sixth Street, Philadelphia, Pa.

Chinese Universities Relief Fund.—The damage inflicted on universities in the course of the Japanese invasion has been enormous, amounting in several instances to complete destruction of all the university buildings and equipment. Concerted action has been taken by students, professors and the Chinese Government to combine the relief of distressed students with the maintenance of some form of training in centres remote from the war theatres, such as Changsha in Hunan Province. Appeals to universities in other lands have been organized by International Student Service for the relief of destitute students and for equiping them in their efforts to carry on their studies. In England there has been a response from every single university and the majority of university colleges, the amount raised in this way up to date being £3,000. The English Committee has undertaken in addition to contributing to the international fund, to assist Chinese students in Great Britain whose funds have been cut off. In a letter to *The Times* of January 7, Sir Walter Moberly, Chairman of the International Student Service, appeals for at least another £2,000. Contributions may be sent to Prof. Ernest Barker, the Hon. Treasurer of the Chinese Universities Relief Fund at 49, Gordon Square, London W.C. 1 (*Nature*, Jan. 22, 1938).

Hops for Distribution.—The Secretary, Research Fund Committee of the Institute of Brewing, announces that a small quantity of hops, *viz.*, 21 pockets and 11 part-pockets of New Varieties, grown at the South-Eastern Agricultural College, Wye, and at the Research Station, East Malling, Kent, are available for purchase by Brewers who are willing to assist the Institute of Brewing in determining their flavour.

Several of these New Varieties have an aroma of the American type, and the co-operation of Brewers, who use American hops, is desired in order to ascertain to what extent these New Varieties could replace American hops.

All communications in regard to this matter should be addressed to the Secretary, Brewers' Hall, Addle Street, London, E.C. 2.

The Food Group of the **Society of Chemical Industry** has formed a Microbiological Panel with a view to holding meetings for the study of the general subject of industrial microbiology. Professor H. Raistrick has been elected Chairman of the Panel and Dr. J. H. Bushill, Honorary Secretary. Anyone interested in any microbiological problem in industry will be welcomed as a member of the Panel, but if not already a member would have to join the Society of Chemical Industry. It is intended that the scope of the Panel will include (*a*) all food industries; (*b*) those industries utilising micro-organisms, *e.g.*, agriculture, dairying, leather, fermentation industries, etc.; (*c*) those industries interested in the prevention of the growth of micro-organisms, *e.g.*, in the microbiological spoilage of any raw or manufactured materials (*Chemical Age*, 1938, Jan. 15, p. 53).

Literary Intelligence.—Messrs. J. & A. Churchill, Ltd., announce that early in January a new (Second) edition of A CHEMICAL DICTIONARY by Professor Ingo W. D. Hackh was published. Dr. Julius Grant has assisted in the preparation of this new edition which contains 230 more pages of new material; nearly 100 new and original tables; new illustrations and diagrams. The price will be 48 *s.*

A fourteenth edition of the famous work by Clowes & Coleman entitled QUANTITATIVE CHEMICAL ANALYSIS will be ready shortly. It has again been edited by Dr. Stockdale and Mr. J. Dexter. The work has been revised thoroughly and many new tables are incorporated. The published price remains at 18 *s.*

In the early Spring it is hoped to issue a second edition of THE CHEMISTRY OF THE PROTEINS by Dr. Jordan Lloyd and Miss Agnes Shore. The advances in this subject have necessitated the virtual re-writing of the book. It will be considerably enlarged and will contain many illustrations.

Of interest to many workers in its special field will be the new (Eleventh) edition of Hawk & Bergeim's PRACTICAL PHYSIOLOGICAL CHEMISTRY. For thirty years this volume has been a standard work and the revised new edition will, it is felt, be as useful as its predecessors. A thorough revision has been made and much new matter is incorporated. The volume is priced at 35 *s.*

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We acknowledge with thanks, receipt of the following:—

"Agricultural Gazette of New South Wales," Vol. 49, No. 1.

"American Museum of Natural History,' Vol. 41, No. 1.

"Allahabad Farmer," Vol. 12, No. 1.

"Biochemical Journal," Vol. 31, No. 12.

"Berichte Der Deutschen Chemischen Gesselschaft," Vol. 71, No. 1.

"Bulletin of the Health Organisation of the League of Nations," Vol. 6, No. 5.

"Bulletin of the American Meteorological Society," Vol. 18, No. 11.

"Canadian Journal of Research," Vol. 15, No. 12.

"Calcutta Medical Journal," Vol. 33, No. 1.

" Current Titles from Engineering Journals," Vol. 1, No. 3.
" The Calcutta Review," Vol. 66, Nos. 1 and 2.
" Chemical Age," Vol. 38, Nos. 965–69.
" Forschungen und Fortschritte," Vol. 14, Nos. 1–3.
" Indian Journal of Agricultural Science," Vol. 7, No. 6.
" Indian Forester," Vol. 64, No. 2.
" Indian Journal of Physics," Vol. 11, No. 5.
" Indian Journal of Venereal Diseases," Vol. 3, No. 4.
" Indian Trade Journal," Vol. 128, Nos. 1647–51.
" Indian Journal of Veterinary Science and Animal Husbandry," Vol. 7, No. 4.
" Journal of Agricultural Research," Vol. 55, Nos. 8 and 9.
" Journal of the Royal Society of Arts," Vol. 85, Nos. 4439–43 and Vol. 86, No. 4444.
" Journal of the Institute of Brewing," Vol. 44, No. 1, and Index to Vol. 33.
" Journal of Chemical Physics," Vol. 6, No. 1.
" Journal of the Indian Chemical Society," Vol. 14, No. 11.
" Journal of Nutrition," Vol. 15, No. 1.
" Journal of Research (National Bureau of Standards)," Vol. 18, No. 6, and Vol. 19, Nos. 1–3.
" Lingnan Science Journal," Vol. 16, No. 4.
" Monthly Bulletin of Agricultural Science and Practice," Vol. 29, No. 1.
" Medico Surgical Suggestions," Vol. 7, No. 1.
" Nature," Vol. 140, Nos. 3557–60.
" The Philippine Agriculturist," Vol. 26, No. 8.
" Review of Applied Mycology," Vol. 16, No. 12.
" Research and Progress," Vol. 4, No. 1.
" Science and Culture," Vol. 3, No. 7.
" Sky," Vol. 2, No. 3.
" Science Progress," Vol. 32, No. 127.
" Transactions of the Faraday Society," Vol. 34, No. 201.

Catalogue.

" Wheldon and Wesley's Catalogue," Part 3, 1938.

ACADEMIES AND SOCIETIES.

Indian Academy of Sciences:

January 1938. SECTION A.—S. S. PILLAI: *On the Addition of Residue Classes.* F. C. AULUCK: *On Conics Connected with Four or More Lines.* S. RANGASWAMI AND T. R. SESHADRI: *Fixation of the Aromatic Double Bonds in the Coumarin Ring System.*—It is concluded from the reactivity of 7-hydroxy coumarin and its derivatives that the nuclear double bonds are not fixed and are capable of assuming alternative positions. C. S. VENKATESWARAN: *The Hydroxyl Frequency in the Raman Spectra of Acids and Acid Salts.*—A weak and diffuse band characteristic of O—H group has been recorded in the Raman spectra of sulphuric, iodic, selenious and telluric acids. The frequency values however are lower than that for a free hydroxyl. This is apparently connected with the formation of hydrogen bonds. R. S. KRISHNAN: *The Reciprocity Theorem in Colloid Optics and its Generalisation.*—The reciprocity relation is deduced theoretically. It is valid for a solution containing a large number of particles which have no preferred orientation in the plane containing the incident and scattered beam, and also for conditions of oblique scattering. The relations for oblique scattering have been experimentally verified in the case of graphite and arsenic trisulphide sol. S. BHAGAVANTAM AND B. SUNDARA RAMA RAO: *Light Scattering and Other Allied Physical Properties of Ordinary and Heavy Water.*—The adiabatic compressibility and depolarisation have been measured. The calculated relative scattering powers of D_2O and H_2O, 1·8 : 2, are in good agreement with observations. P. NILAKANTAN: *Magnetic Anisotropy of naturally occurring Substances. III.—Wood and its constituents.*—It is found that the 'crystalline' element in wood is definitely cellulose, and that the direction of maximum diamagnetic susceptibility in the cellulo. molecule is along the length of the chain. BAWA KARTAR SINGH: *The Physical Identity of Enantiomers. Part V.—The relation between concentration and viscosity of solutions of* d-, l-, *and* dl- *forms of Camphor,* Iso-*nitroso Camphors, Camphor quinone, Camphoric Acid, and Sodium Camphorate.* A. NARASINGA RAO: *On the Miquel-Clifford Configuration.*

January 1938. SECTION B.—D. N. MAJUMDAR: *The Relationships of the Austric-speaking Tribes of India, with Special Reference to the Measurements of Hos and Saoras.*—From an analysis of two new series of anthropometric measurements of Hos and Saoras, and by a comparison of the statistical constants with those of the series available, it is shown that four distinct ethnic groups are represented among the Austric-speaking tribes. S. N. DAS GUPTA: *On the Culture Behaviour of a Species of* Rosellinia *II.—Further Experiments in the Production of Perithecia.*—The effect of various chemicals—asparagin, potassium nitrate, acid, alkali and C/N ratio on the production of *perithecia* in a species of *Rosellinia* is recorded. B. KRISHNAMURTI: A *Microscopical Study of the Development of* Trichogramma minutum *Riley* (*The Egg Parasite of the Sugarcane Borers in Mysore*) *and its Parasitisation of the Eggs of* Corcyra-cephalonica *Staint* (*The Flour-moth employed in the Mass Production of* Trichogramma. P. SEN: *On a New Species of Acanthocephala,* Acanthocentis holospinus *sp. nov. from the Fish* Barbus stigma (*Cuv. and Val.*).—The morphology and anatomy of the parsites obtained from fish guts are recorded. COL. I. FROILANO DE MELLO AND LUIS DA FONSECA: *On the Schizogonic Forms of a Plasmodid found in the Blood of the Green Snake,* Passerita mycterizans *Daud.*

Meteorological Office Colloquium, Poona:

December 14, 1937.—Dr. S. K. Banerji—On the theory of cyclone formation at extra-tropical fronts and developed by Norwegian meteorologists,